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THE

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Durazzo
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Saseno
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Santa Maria di Leuca
Corfu
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Ithaca
Zante
Port Suda
Constantinople
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THE NATIONAL GEOGRAPHIC MAGAZINE

MAP OF THE COUNTRIES BORDERING THE MEDITERRANEAN SEA

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THE SEA-KINGS OF CRETE

BY REV. JAMES BAIKIE

Explorers with the spade have been making discoveries in Crete which have completely altered our ideas of early civilization in the Ægean Sea. They have found that Crete was the home of the first great sea power, and that more than a thousand years before the time of the Phœnicians, who generally have been credited with inventing writing, the Cretans devised and used the linear characters, which the Phœnicians simply adapted. The Cretans were curiously modern in their dress and habits. Pictures have been uncovered showing ladies long before the time of Homer dressed in Parisian styles, with big hats, high heels, and tight-laced corsets. The houses and the methods of sanitation were extremely modern, far surpassing anything known in civilized times until the last 50 years. Rev. James Baikie, of Edinburgh, has written an entertaining and instructive book summarizing the results of these explorations, particularly those by Dr. A. J. Evans, the pioneer and chief of Cretan explorers. From this book, "The Sea-Kings of Crete," Adam and Charles Black, publishers (New York, The Macmillan Co.), the following article has been abstracted by the Editor. The illustrations, by Dr. A. J. Evans, are from the same source.

THE present generation has witnessed remarkable discoveries in Mesopotamia and in Egypt, but neither Niffur nor Abydos disclosed a world so entirely new and unexpected as that which has been revealed by the work of Schliemann and his successors at Troy, Mycenæ, and Tiryns, and by that of Evans and the other explorers—Italian, British, and American—in Crete.

It was obvious that mighty men must have existed before Agamemnon, but what manner of men they were and in what manner of world they lived were matters absolutely unknown and, to all appearance, likely to remain so. An abundant wealth of legend told of great kings and heroes, of stately palaces, and mighty armies, and powerful fleets, and the whole material of an advanced civilization. But the legends were manifestly largely imaginative—deities and demigods, men and fabulous monsters, were mingled in them on the same plane—and it seemed impossible that we should ever get back to the solid ground, if solid ground had ever existed, on which these ancient stories first rested.

For the historian of the middle of the nineteenth century Greek history began with the First Olympiad, in 776 B. C. Before that the story of the return of the Herakleids and the Dorian conquest of the men of the Bronze Age might very probably embody, in a fanciful form, a genuine historical fact; the Homeric poems were to be treated with respect, not only on account of their supreme poetical merit, but as possibly representing a credible tradition, though, of

THE CUP-BEARER: KNOSSOS

"The colors were almost as brilliant as when laid down over three thousand years before. For the first time the true portraiture of a man of this mysterious Mycenaean race rises before us. The limbs are finely moulded, though the waist is tightly drawn in by a silver-mounted girdle, giving great relief to the hips. The profile of the face is pure and almost classically Greek. . . . There was something very impressive in the vision of brilliant youth and of male beauty, recalled after so long an interval to our upper air from what had been till yesterday, a forgotten world. Our untutored Cretan workmen regarded the discovery of such a painting in the bosom of the earth as nothing less than miraculous, and saw in it the icon of a saint."—A. J. Evans (see pages 13 and 14).

course, their pictures of advanced civilization were more or less imaginative projections upon the past of the culture of the writer's own period or periods. Beyond that lay the great waste land of legend, in which gods and godlike heroes moved and enacted their romances among "Gorgons and Hydras and Chimeras dire."

What proportion of fact, if any, lay in the stories of Minos, the great law-giver, and his war fleet, and his Labyrinth, with its monstrous occupant; of Theseus and Ariadne and the Minotaur; of Dædalus, the first aeronaut, and his wonderful works of art and science; or of any other of the thousand and one beautiful or tragic romances of ancient Hellas, to attempt to determine this lay utterly beyond the sphere of the serious historian.

"To analyze the fables," says Grote, "and to elicit from them any trustworthy particular facts appears to me a fruitless attempt."

Grote's frankly skeptical attitude represents fairly well the general opinion of the middle of last century. The myths were beautiful, but their value was not in any sense historical; it arose from the light which they cast upon the workings of the active Greek mind, and the revelation which they gave of the innate poetic faculty which created myths so far excelling those of any other nation.

Opinions like that so dogmatically expressed by our great historian are no longer held by any one who has followed the current of modern investigations, and remain only as monuments of the danger of dogmatizing on matters concerning which all preconceived ideas may be upset by the result of a single season's spade-

work on some ancient site; and he would be a bold man who would venture today to call "illusory" the search for "points of solid truth" in the old legends, or to assert that "the items of matter of fact, if any such there be," are inextricable from the mass of romantic inventions in which they are embedded.

WHAT CRETE HAS REVEALED

The resurrection of the prehistoric age of Greece and the disclosure of the astonishing standard of civilization which had been attained on the mainland and in the isles of the Ægean at a period at least 2,000 years earlier than that at which Greek history, as hitherto understood, begins may be reckoned as among the most interesting results of modern research into the relics of the life of past ages.

The work, of course, is by no means complete; very probably it is scarcely more than well begun; but already the dark gulf of time that lay behind the Dorian conquest is beginning to yield up the unquestionable evidences of a great, and splendid, and almost incredibly ancient civilization, which neither for its antiquity nor for its actual attainment has any cause to shrink from comparison with the great historic civilizations of Mesopotamia or the Nile Valley.

It is not yet possible to trace and identify the actual figures of the heroes of prehistoric Greece; probably it never will be possible, unless the as yet untranslated Cretan script should furnish the records of a more ancient Herodotus, and a new Champollion should arise to decipher them; but there can scarcely be any reasonable doubt that genuine men and women of Ægean stock filled the rôles of these ancient romances, and that the wondrous story of their deeds is, in part at least, the record of actual achievements.

In this remarkable resurrection of the past the most important and convincing part has been played by the evidence from Crete. The discoveries which were made during the last quarter of the nineteenth century, by Schliemann and his successors, at Mycenæ, Tiryns, Orchomenos, and elsewhere were quite conclusive as to the former existence of a civilization quite equal to, and in all probability the original of, that which is described for us in the Homeric poems; but it was not until the treasures of Knossos and Phæstos in Crete began to be revealed that it became manifest that what was known as the Mycenæan civilization was itself only the decadence of a far richer and fuller culture, whose fountain-head and whose chief sphere of development had been in Crete.

And it has been in Crete that exploration and discovery have led to the most striking illustration of many of the statements in the legends and traditions, and have made it practically certain that much of what used to be considered mere romantic fable represents, with, of course, many embellishments of fancy, a good deal of historic fact.

The position of Crete—"a halfway house between three continents, flanked by the great Libyan promontory, and linked by smaller island stepping-stones to the Peloponnese and the mainland of Anatolia"—marks it out as designed by Nature to be a center of development in the culture of the early Ægean race, and in point of fact ancient traditions unanimously pointed to the great island as being the birthplace of Greek civilization.

WHO WAS MINOS?

It was the surprising claim of the Cretans to possess the burial place of the supreme God of Hellas which first attached to them the unenviable reputation for falsehood which clung to them throughout the classical period, and was crystallized by Callimachus in the form adopted by St. Paul in the Epistle to Titus—"The Cretans are always liars."

It is round Minos, the son of Zeus and Europa, that the bulk of the Cretan legends gathers. The suggestion has been made, with great probability, that the name Minos is not so much the name of a single person as the title of a race of kings. "I suspect," says Professor Murray, "that Minos was a name, like 'Pharaoh' or 'Cæsar,' given to all Cre-

tan kings of a certain type." With that, however, we need not concern ourselves at present, further than to notice that the bearer of the name appears in the legends in many different characters, scarcely consistent with one another or with his being a single person.

The Minos who is most familiar to us in Greek story is not so much the lawgiver and priest of God as the great sea-king and tyrant, the overlord of the Ægean, whose vengeance was defeated by the bravery of the Athenian hero, Theseus. From this point of view, Minos was the first of men who recognized the importance of sea-power, and used it to establish the supremacy of his island kingdom.

But the great King was by no means so fortunate in his domestic relationships as in his foreign advertures. The domestic skeleton in his case was the composite monster the Minotaur, half man, half bull, fabled to have been the fruit of a monstrous passion on the part of the king's wife, Pasiphæ. This monster was kept shut up within a vast and intricate building called the Labyrinth, contrived for Minos by his renowned artificer, Dædalus. Further, when his own son, Androgeos, had gone to Athens to contend in the Panathenaic games, having overcome all the other Greeks in the sports, he fell a victim to the suspicion of Ægeus, the King of Athens, who caused him to be slain, either by waylaying him on the road to Thebes or by sending him against the Marathonian bull.

In his sorrow and righteous anger, Minos raised a great fleet and levied war upon Athens; and, having wasted Attica with fire and sword, he at length reduced the land to such straits that King Ægeus and his Athenians were glad to submit to the hard terms which were asked of them. The demand of Minos was that every ninth year Athens should send him as tribute seven youths and seven maidens. These were selected by lot, or, according to another version of the legend, chosen by Minos himself, and on their arrival in Crete were cast into the Labyrinth, to become the prey of the monstrous Minotaur.

THESEUS, THE DELIVERER OF ATHENS

The first and second installments of this ghastly tribute had already been paid; but when the time of the third tribute was drawing nigh, the predestined deliverer of Athens appeared in the person of the hero Theseus. Theseus was the unacknowledged son of King Ægeus and the Princess Aithra of Troezen. He had been brought up by his mother at Troezen, and on arriving at early manhood had set out to make his way to the court of Ægeus and secure acknowledgment as the rightful son of the Athenian king.

The legend tells how on his way to Athens he cleared the lands through which he journeyed of the pests which had infested them. Sinnis, the pine-bender, who tied his miserable victims to the tops of two pine trees bent toward one another and then allowed the trees to spring back, the young hero dealt with as he had dealt with others; Kerkuon, the wrestler, was slain by him in a wrestling bout; Procrustes, who enticed travelers to his house and made them fit his bed, stretching the short upon the rack and lopping the limbs of the over-tall, had his own measure meted to him; and various other plagues of society were abated by the young hero.

Not long after his arrival at Athens and acknowledgment by his father the time came round when the Minoan heralds should come to Athens to claim the victims for the Minotaur. Seeing the grief that prevailed in the city, and the anger of the people against his father, Ægeus, whom they accounted the cause of their misfortune, Theseus determined that, if possible, he would make an end of this humiliation and misery, and accordingly offered himself as one of the seven youths who were to be devoted to the Minotaur.

Ægeus was loth to part with his newly-found son, but at length he consented to the venture; and it was agreed that if Theseus succeeded in vanquishing the Minotaur and bringing back his comrades in safety he should hoist white sails on his returning galley instead of

the black ones which she had always borne in token of her melancholy mission.

ARIADNE SAVES THESEUS

So at length the sorrowful ship came to the harbor in the bay below broad Knossos, where Minos reigned, and when the King had viewed his captives they were cast into prison to await their dreadful doom. But fair-haired Ariadne, the daughter of Minos, had marked Theseus as he stood before the King, and love to him had risen up in her heart, and pity at the thought of his fate; and so by night she came to his dungeon, and when she could not persuade him to save himself by flight, because that he had sworn to kill the Minotaur and save his companions, she gave him a clue of thread by which he might be able to retrace his way through all the dark and winding passages of the Labyrinth, and a sword wherewith to deal with the Minotaur when he encountered him.

ONE OF THE MANY MAGAZINES, WITH JARS AND KASELLES FOR THE STORAGE OF GRAIN AND OIL, FOUND AT KNOSSOS

"Down the center line of each magazine ran a row of small square openings in the floor—'kaselles' as they came to be called—which at one time had evidently been receptacles, some of them perhaps for oil, but some of them certainly for valuables. They were carefully lined with lead, and in some cases the slabs of stone covering them could not be removed without lifting the whole pavement. In spite of such precautions, however, they had been well rifled in ancient days, and little was left to tell of what their contents may once have been." The immense size of these jars may be appreciated by noting the boy standing in the background.

So Theseus was led away by the guards and put into the Labyrinth to meet his fate; and he went on, with the clue which he had fastened to his arm unwinding itself as he passed through passage after passage, until at last he met the dreadful monster; and there, in the depths of the Labyrinth, the Minotaur, who had slain so many, was himself slain.

Then Theseus and his companions escaped, taking Ariadne with them, and fled to their black ship and set sail for Attica again; and landing for awhile in the island of Naxos, Ariadne there became the hero's wife. But she never came to Athens with Theseus, but was either deserted by him in Naxos or, as

some say, was taken from him there by force. So, without her, Theseus sailed again for Athens.

But in their excitement at the hope of seeing once more the home they had thought to have looked their last upon, he and his companions forgot to hoist the white sail; and old Ægeus, straining his eyes on Sunium day after day for the returning ship, saw her at last come back black-winged as he had feared; and in his grief he fell, or cast himself, into the sea, and so died, and thus the sea is called the Ægean to this day.

THE UNHAPPY FATE OF MINOS

So runs the great story which links Minos and Crete with the favorite hero of Athens. But other legends, not so famous nor so romantic, carry on the story of the great Cretan King to a miserable close. Dædalus, his famous artificer, was also an Athenian, and the most cunning of all men. To him was ascribed the invention of the plumb-line and the auger, the wedge and the level; and it was he who first set masts in ships and bent sails upon them. But having slain, through jealousy, his nephew Perdix, who promised to excel him in skill, he was forced to flee from Athens, and so came to the Court of Minos.

For the Cretan King he wrought many wonderful works, rearing for him the Labyrinth and the Choros, or dancing-ground, which, as Homer tells us, he "wrought in broad Knossos for fair-haired Ariadne." But for his share in the great crime of Pasiphæ, Minos hated him, and shut him up in the Labyrinth which he himself had made.

Then Dædalus made wings for himself and his son Icarus, and fastened them with wax, and together the two flew from their prison-house high above the pursuit of the King's war-fleet. But Icarus flew too near the sun, and the wax that fastened his wings melted, and he fell into the sea. So Dædalus alone came safely to Sicily, and was there hospitably received by King Kokalos of Kamikos, for whom, as for Minos, he executed many marvelous works. Then Minos, still thirsting for revenge, sailed

A GREAT JAR: KNOSSOS

with his fleet for Kamikos to demand the surrender of Dædalus; and Kokalos, affecting willingness to give up the fugitive, received Minos with seeming friendship, and ordered the bath to be prepared for his royal guest. But the three daughters of the Sicilian King, eager to protect Dædalus, drowned the Cretan in the bath, and so he perished miserably. And many of the men who had sailed with him remained in Sicily, and founded there a town which they named Minoa, in memory of the murdered King.

THE GREAT GULF OF DARKNESS IS DISAPPEARING

Between the Greece of such legends as those which we have been considering and the Greece of the earliest historic period there has always been a great gulf of darkness. On the one side a land of seemingly fabulous kings and heroes and monsters, of fabulous palaces and cities; on the other side, Greece as we know it in the infant stages of its development, with a totally different state of society,

a totally different organization and culture; and in the interval no one could say how many generations, concerning which and their conditions and developments, there was nothing but blank ignorance. So that it seemed as though the marvelous fabric of Greek civilization as we know it were indeed something unexampled, rising almost at once out of nothing to its height of splendor, as the walls of Illium were fabled to have risen beneath the hands of their divine builders.

Indeed, a certain section of students seemed rather to glory in the fact of this seeming isolation of Greek culture, and to deem it little short of profanity to seek any pre-existing sources for it. "Allowing no causation more earthly than vague local influences of air and light, mountain and sea, they would have Hellenism born into the world by a miracle of generation, like its own Athens from the head of Zeus."

But a great civilization can never be accounted for in this miraculous fashion. The origins of even Egyptian culture have begun to yield themselves to patient research, and it is not permissible to believe that the Greek nation was born in a day into its great inheritance, or that it derived nothing from earlier ages and races.

DR. EVANS DISCOVERS THE LABYRINTH OF THE LEGENDS AT KNOSSOS

Most of these traditions clustered round Knossos, the famous capital of Minos, where once stood the Labyrinth, and near to which was Mount Juktas, the traditional burying-place of Zeus.

Dr. A. J. Evans, the chief of Cretan explorers, discovered the site of the Great Palace of Minos, at Knossos, near modern Candia, and has uncovered it to the world. The palace is an enormous building, rivaling in size and magnificence the greatest palaces of ancient days.

"There can be little remaining doubt," says Dr. Evans, "that this vast edifice, which in a broad historic sense we are justified in calling the 'Palace of Minos,' is one and the same as the traditional 'Labyrinth.' A great part of the ground-plan itself, with its long corridors and repeated successions of blind galleries, its tortuous passages and spacious underground conduits, its bewildering system of small chambers, does in fact present many of the characteristics of a maze."

THE EARLIEST KNOWN SCRIPT DISCOVERED IN CRETE

But the discovery which will doubtless prove in the end to be of greater importance than any other, though as yet the main part of its value is latent, was that of large numbers of clay tablets incised with inscriptions in the unknown script of the Minoans. Over a thousand have been collected from various deposits in the palace. Of these deposits, one contained tablets written in hieroglyphic; but the rest were in the linear script, "a highly developed form, with regular divisions between the words and for elegance scarcely surpassed by any later form of writing."

The tablets vary in shape and size, some being flat, elongated bars from two to seven and a half inches in length, while others are squarer, ranging up to small octavo. Some of them, along with the linear writing, supply illustrations of the objects to which the inscriptions refer. There are human figures, chariots and horses, cuirasses and axes, houses and barns, and ingots followed by a balance, and accompanied by numerals which probably indicate their value in Minoan talents. It looks as though these were documents referring to the royal arsenals and treasuries.

"Other documents, in which neither ciphers nor pictorial illustrations are to be found, may appeal even more deeply to the imagination. The analogy of the more or less contemporary tablets, written in cuneiform script, found in the Palace of Tell-el-Amarna, might lead us to expect among them the letters from distant governors or diplomatic correspondence. It is probable that some of them are contracts or public acts, which may give some actual formulæ of Minoan legislation.

"There is indeed an atmosphere of legal nicety, worthy of the House of Minos, in the way in which these records were secured. The knots of string

which, according to the ancient fashion, stood in the place of locks for the coffers containing the tablets were rendered inviolable by the attachment of clay seals, impressed with the finely engraved signets, the types of which represented a great variety of subjects, such as ships, chariots, religious scenes, lions, bulls, and other animals. But—as if this precaution was not in itself considered sufficient—while the clay was still wet the face of the seal was countermarked by a controlling official and the back countersigned and endorsed by an inscription in the same Mycenæan script as that inscribed on the tablets themselves."—Dr. A. J. Evans.

THE TABLETS WERE PRESERVED BY THE GREAT FIRE

The tablets had been stored in coffers of wood, clay, or gypsum. The wooden coffers had perished in the great conflagration which destroyed the palace, and only their charred fragments remained; but the destroying fire had probably contributed to the preservation of the precious writings within by baking more thoroughly the clay of which they were composed.

As yet, in spite of all efforts, it has not proved possible to decipher the inscriptions, for there has so far been no such good fortune as the discovery of a bilingual inscription to do for Minoan what the Rosetta Stone did for Egyptian hieroglyphics. But it is not beyond the bounds of probability that there may yet come to light some treaty between Crete and Egypt which may put the key into the eager searcher's hands, and enable us to read the original records of this long-forgotten kingdom.

Even as it is, the discovery of these tablets has altered the whole conception of the relative ages of the various early beginnings of writing in the Eastern Mediterranean area. The Hellenic script is seen to have been in all likelihood no late-born child of the Phœnician, but to have had an ancestor of its own race.

"Thus," said Dr. Evans, "that great early civilization was not dumb, and the written records of the Hellenic world were carried back some seven centuries beyond the date of the first-known historic writings.

"But what, perhaps, is even more remarkable than this, is that, when we examine in detail the linear script of these Mycenæan documents, it is impossible not to recognize that we have here a system of writing, syllabic and perhaps partly alphabetic, which stands on a distinctly higher level of development than the hieroglyphics of Egypt or the cuneiform script of contemporary Syria and Babylonia. It is not till some five centuries later that we find the first dated examples of Phœnician writing."

The old Cretan tradition that the Phœnicians did not invent the letters of the alphabet, but only changed those already existing, is thus amply justified, for this seems to have been precisely what they did. The Phœnician mind, if not original, was at all events practical. The great stumbling-block in the way of the ancient scripts was their complexity—a fault which the Minoan users of the Linear script had evidently already begun to recognize and endeavor to amend.

What the Phœnicians did was to carry the process of simplification farther still, and to appropriate for their own use out of the elements already existing around them a conveniently short and simple system of signs. The position which they came to occupy, after the Minoan Empire of the sea had passed away, as the great carriers and middlemen of the Mediterranean, gave their system a spread and a utility possible to no other system of writing; and so the Phœnician alphabet gradually came to take its place as the basis of all subsequent scripts.

Unquestionably it was a great and important service which was thus rendered by them; but, all the same, the beginnings of European writing must be traced not to them, but to their predecessors, the Minoans, and the clay tablets of Knossos, Phæstos, and Hagia Triada are the lineal ancestors of all the written literature of Europe.

THE KING'S GAMING-BOARD

The king's gaming-board was a splendid and convincing proof of the magnificence of the appointments of the house of Minos in its palmy days. This was a

board which had evidently been designed for use in some game, perhaps resembling draughts or chess, in which men were moved to and fro from opposite ends. The board was over a yard in length and rather more than half a yard in breadth (see page 20).

Its framework was of ivory, which had originally been overlaid with thin gold plate, and it was covered with a mosaic of strips and discs of rock-crystal, which in their turn had been backed alternately with silver and blue enamel paste. Round its margin ran a border of marguerites whose central bosses were convex discs of rock-crystal which had probably been set originally in a blue paste background.

At the top of the board were four beautiful reliefs representing nautilus shells, set round with crystal plaques and bossed with crystal. Below them came four large medallions, set among crystal bars backed with silver plate, and then eleven bars of ribbed crystal and ivory alternating with one another. Eight shorter bars of crystal backed with blue enamel fill spaces on either side of the topmost section in the lower part of the board, which consists of a two-winged compartment with ten circular openings, the medallions of which have been broken out, but were probably of crystal backed with silver. The remaining space of the board was filled with flat bars of gold-plated ivory alternating with bars of crystal on the blue enamel setting.

The mere summary of its decoration conveys no idea of the splendor of a piece of work which, as Professor Burrows says, "defies description, with its blaze of gold and silver, ivory and crystal." The late Minoan monarch who used it—for so gorgeous a piece of workmanship can scarcely have been designed for any one but a king—must have been as splendid in his amusements as in all the other appointments of his royalty.

BULL-FIGHTS 4,000 YEARS AGO

The gaming-board suggested the lighter and more innocent side of the palace life (see page 20). A darker and more tragic aspect of it was hinted at by the fresco which was found among debris fallen from a chamber overlooking the so-called Court of the Olive Spout. This was a picture of those sports of the arena in which the Minoan and Mycenæan monarchs evidently took such delight, and in which the main figures were great bulls and toreadors. In this case the picture is one of three toreadors, two girls and a boy, with a single bull. The girls are distinguished by their white skins, the more vari-colored costumes, their blue and red diadems, and their curlier hair, but are otherwise dressed like their male companion.

In the center of the picture the great bull is seen in full charge. The boy toreador has succeeded in catching the monster's horns and turning a clean somersault over his back, while one of the girls holds out her hands to catch his as he comes to the ground. But the other girl, standing in front of the bull, is just at the critical moment of the cruel sport. The great horns are almost passing under her arms, and it looks almost an even chance whether she will be able to catch them and vault, as her companion has done, over the bull's back, or whether she will fail and be gored to death.

With such a sport, in which life or death depended upon an instant, in which a slip of the foot, a misjudgment of distance, or a wavering of hand or eye meant horrible destruction, we may be sure that the tragedies of the Minoan bull-ring were many and terrible, and that the fair dames of the Knossian palace, modern in costume and appearance as they seem to us, were as habituated to scenes of cruel bloodshed as any Roman lady who watched the sports of the Colosseum and saw gladiators hack one another to pieces for her pleasure.

That the sport of the bull-ring, and particularly this exciting and dangerous game of bull-grappling, was an established and habitual form of Minoan sport is proved by the multitude of representations of it which have survived. The charging bull of Tiryns, the first to be discovered, was a mystery so long as it stood alone; but it is only one of a succession of such pictures—painted upon walls, engraved upon gems, and

RELIEF OF BULL'S HEAD, FOUND IN THE GREAT PALACE AT KNOSSOS, CRETE, BY DR. A. J. EVANS

This and the other illustrations in this article are from "The Sea-Kings of Crete," by Rev. James Baikie. Adam and Charles Black, publishers

stamped on seal impressions—which show that the Cretans and Mycenæans were as fond of their bull-fights as a modern Spaniard of his.

THE DUNGEONS OF MINOS

Where did they get the toreadors, male and female, whose lives were to be devoted to such a terrible sport—a sport practically bound to end fatally, sooner or later? We may be fairly sure, at all events, that bull-grappling was not taken up voluntarily even by the male, and still less by the female, toreadors; and one of the discoveries made gave its own suggestion of an explanation.

Not very far from the north entrance of the palace, beneath the room where had been found the fresco of the Little Boy Blue gathering crocuses—an innocent figure to cover so grim a revelation (see page 13)—there came to light the walls of two deep pits, going right down, nearly 25 feet, to the virgin soil. The pits were lined with stonework faced with smooth cement, and it seems most probable that these were the dungeons of the palace, in which we may imagine that the miserable captives brought back by the great king's fleet from its voyages of conquest and plunder, and the human tribute paid by the conquered states, dragged out their existence until the time came for them either to be trained for the cruel sport to which they were devoted, or actually to take their places in the bull-ring.

If it be so, then the dungeons of Minos would keep their captives securely enough; escape from the deep pits, with their smooth and slippery walls, must have been practically impossible, save by connivance on the part of the guards or by the intervention of some tender-hearted Ariadne.

If those dark walls could only reveal the story of the doomed lives which they once imprisoned, we should probably be able to realize, even more fully than we do, the shadowed side of all the glittering splendor of Knossos, and the grim element of barbaric cruelty which mingled with a refined artistic taste and a delight in all forms of beauty.

In none of these great civilizations of the ancient world were splendor and cruelty separated by any great interval from one another, nor was a very remarkable degree of refinement inconsistent with a carelessness of life, and even such a thirst for blood, as we consider more natural in a savage state; but it is seldom that the evidences of the two things lie so close to one another as where at Knossos the innocent figure of the crocus-gatherer almost covers the very mouth of the horrible pit in which the captives of Minos waited for the day when their lives were to be staked on the hazard of the arena.

THE DRAINAGE SYSTEM WAS MARVELOUSLY MODERN

Most surprising of all, however, in many respects, was the revelation of the amazingly complete system of drainage with which the palace was provided. The gradient of the hill which underlay the domestic quarter of the palace enabled the architect to arrange for a drainage system on a scale of completeness which is not only unparalleled in ancient times, but which it would be hard to match in Europe until a period as late as the middle of the nineteenth century of our era. A number of stone shafts, descending from the upper floors, lead to a well-built stone conduit, measuring one meter by one-half meter, whose inner surface is lined with smooth cement. These shafts were for the purpose of leading into this main conduit the surface water from the roofs of the palace buildings, and thus securing a periodical flushing of the drains. In connection with this surface-water system there was elaborated a system of latrines and other contrivances of a sanitary nature, which are "staggeringly modern" in their appointments.

In the northeastern quarter, under the Corridor of the Game-Board, are still preserved some of the terra-cotta pipes which served as connections to the main drain. They are actually faucet-jointed pipes of quite modern type, each section two and one-half feet in length and six inches in diameter at the wide end, and narrowing to four inches at the smaller end. "Jamming was carefully prevented

by a stop-ridge that ran round the outside of each narrow end a few inches from the mouth, while the inside of the butt, or broader end, was provided with a raised collar that enabled it to bear the pressure of the next pipe's stop-ridge, and gave an extra hold for the cement that bound the two pipes together."—Dr. A. J. Evans.

Indeed, the hydraulic science of the Minoan architects is altogether wonderful in the completeness with which it provided for even the smallest details. On a staircase near the east bastion, on the lower part of the slope, a stone runnel for carrying off the surface water follows the line of the steps. Lest the steepness of the gradient should allow the water to descend too rapidly and flood the pavement below, the runnel is so constructed that the water follows a series of parabolic curves, and the rapidity of its fall is thus checked by friction.

The main drains are duly provided with manholes for inspection, and "are so roomy," says Dr. Evans, "that two of my Cretan workmen spent days within them clearing out the accumulated earth and rubble without physical inconvenience." Those who remember the many extant descriptions of the sanitary arrangements, or rather the want of sanitary arrangements, in such a town as the Edinburgh of the eighteenth century will best appreciate the care and forethought with which the Minoan architects, more than 3,000 years earlier, had provided for the sanitation of the great Palace of Minos.

We are, unfortunately, without any evidence as to the appearance of the great palaces in their finished state. The inner plan can be traced, but it is difficult to arrive at any idea of what these huge buildings must have looked like from the outside. It is fairly evident, however, that there cannot have been any symmetrical balancing of the different architectural features.

The palaces were more like small towns than simple residences, and the impression made upon the eye must have been due more to the great mass and extent of the building than to any symmetry of plan. Probably we must conceive of them as great complex blocks of solid building, rising in terrace above terrace, the flat roofs giving the appearance of squareness and solidity to the whole. On a closer approach the eye would be impressed by the wide and spacious courts, the stately porticoes, the noble stairways, and the wealth of color everywhere displayed; but, on the whole, so far as can be judged, it was only from within that the splendor of the Minoan palaces could be fairly estimated.

A palace such as that of Knossos sheltered an extraordinary variety and complexity of life. An abundance of humbler rooms served for the accommodation of the artists and artisans who were needed for the service and adornment of the palace, and of whom whole companies must have lived within the walls, "dwelling with the king for his work," like the potters and foresters mentioned in Scripture. Several shrines and altars provided for the religious needs of the community. Rooms of state were set apart for public audiences and for council meetings. In fact, the building was not only a king's dwelling place, but the administrative center of a whole empire, and within its walls there was room for the housing of their records.

THE THRONE OF MINOS

The discovery of the very throne of Minos—for such we may fairly term it—was surely the most dramatic and fitting recompense for Dr. Evans' patience and persistence. No more ancient throne exists in Europe, or probably in the world, and none whose associations are anything like so full of interest.

The throne-room still preserved among its débris many relics of former splendor. Fragments of blue and green porcelain, of gold-foil, and lapis lazuli and crystal were scattered on the floor, and several crystal plaques with painting on the back, among them an exceedingly fine miniature of a galloping bull on an azure ground, while an agate plaque bearing a relief of a dagger laid upon a folded belt almost equalled cameo-work in the style and delicacy of its execution.

Photo from "The Sea-Kings of Crete," by Rev. James Baikie

A MAGNIFICENT VASE WITH PAPYRUS RELIEFS, FOUND IN THE ROYAL VILLA

In a small room on the north side of the central court was found a curiously quaint and delicate specimen of early fresco painting, the figure of a Little Boy Blue, more thoroughly deserving of the title than Gainsborough's famous picture; for, strangely enough, he is blue in his flesh-tints, picking and placing in a vase the white crocuses that still dapple the Cretan meadows.

FRESCOES OF WONDERFUL BEAUTY PRESERVED FOR 3,500 YEARS

The northern side of the palace was finished with another portico, and in this part of the building there came to light a series of miniature frescoes, valuable not only as works of art, but as contemporary documents for the appearance, dress, and surroundings of the mysterious people to whom this great building was once home.

Here were groups of ladies with the conventional white complexion given by the Minoan artists to their womankind, wonderfully bedizened with costumes resembling far more closely the evening dress of our own day than the stately robes of classic Greece, with their severe lines. In their very low-necked dresses,

THEATRAL AREA, KNOSSOS, RESTORED (NEAR MODERN CANDIA)

with puffed sleeves, excessively slender waists and flounced skirts, and their hair elaborately dressed and curled, they were as far as possible removed from our ideas of Ariadne and her maids of honor, and might almost have stepped out of a modern fashion-plate.

"Mais," exclaimed a French savant, on his first view of them; "mais ce sont des Parisiennes" (see also page 16).

The domestic quarter of the palace still reveals in some of its rooms the environment of luxury and beauty in which the Minoan royalties lived. The Queen's megaron may be taken as typical. A row of pillars rising from a low, continuous base divides the room into two parts. The upper surface of the base on either side of the pillars is of stucco molded so as to form a long couch, which was doubtless covered with cushions when the room was in use. Light was furnished in the daytime, according to Cretan palace practice, not by windows, but by light-wells, of which there are two, one on the south and one on the east side.

In one of these light-shafts the brilliant white stucco surface which reflected the light into the room is decorated with a modeled and painted relief, of which a fragment has survived, representing a bird of gorgeous plumage, with long, curving wing and feathers of red, blue, yellow, white, and black. Near the light-well, on the other side of the line of pillars, outside nature was brought within doors by a beautiful piece of fresco painting, which shows fishes swimming through the water and dashing off foam-bells and ripples in their rapid course.

Along the north wall of the room ran another gay fresco, representing a company of dancing girls on a scale of half life-size. One of the dancers is clad in a jacket with a yellow ground and blue and red embroidered border, beneath

which is a diaphanous chemise. Her left arm is bent and her right stretched forward; her features are piquant, if not beautiful, and a slight dimple shows at the corner of her lips. Her long black hair, elaborately waved and crimped, floats out on either side of her head as she turns in the movement of the dance.

The fragments of decoration which have survived help us to realize a very beautiful room, gay with color, yet never garish because of the softness of the indirect illumination, in which we may imagine the Minoan court ladies, in their modern gowns, reclining on the cushions of the long couch, discussing the incidents of the last bull-grappling entertainment, the skill of the young Athenian, Theseus, and the obvious infatuation of Princess Ariadne, or employing their time more usefully in some of the wonderful embroidery work in which the fashion of the period delighted.

By night the scene in the palace would be even more picturesque. Great stone lamps, standing on tall bases and each bearing several wicks on the margin of its broad bowl of oil, flared in the rooms and corridors, lighting up the brightly colored walls and sending many-tinted reflections dancing from the bronze and copper vases and urns which decorated the passages and the landings of the stairways, while through the breadths of light and shadow moved in an always changing stream of color the gaily dressed figures of the Minoan court.

THE DRESS OF THE MEN WAS VERY SIMPLE; OF THE WOMEN MOST ELABORATE AND MODERN

Judging from the surviving pictures, the Minoan men were bronzed, with dark hair and beardless faces, their figures were slender, and their slenderness was made all the more conspicuous by the fashion which prevailed of drawing in the waist by a tightly fastened belt, which seems, in some cases at least, to have had metal edges; but muscularly they were well developed, and the pictures suggest litheness and agility in a high degree. "One would say a small-boned race, relying more on quickness of limb and brain than on weight and size."

The hair of the men was worn in a somewhat elaborate fashion, being done up in three coils on the top of the head, while the ends of it fell in three long curls upon the shoulders. On the other hand, their dress was extremely simple, consisting normally of nothing but a loin-cloth, girt by the broad belt already mentioned, the material of which the loin-cloth was made being frequently gaily colored or patterned, as in the case of the Cup-Bearer, whose garment is adorned with a dainty quatre-foil design.

That more elaborate robes were worn on certain occasions of importance is shown by the sarchophagus at Hagia Triada, where the Lyre-Player wears a long robe coming down to the ankles and bordered with lines of color, while the other men in the scene wear tucked robes reaching a little below the knees (or possibly baggy Turkish trousers); and also by the Harvester Vase, where the chief figure in the procession is clad in a stiff garment, which has been variously interpreted as a wadded cuirass, or as a cope of some stiff fabric.

On their feet they wore sometimes shoes, with puttees twisted round the lower part of the leg, and sometimes half-boots, as shown on the Chieftain Vase and one of the Petsofa figurines. Indeed, the footgear of the Minoans seems to have been somewhat elaborate. In the representations of the Keftiu, on the walls of Rekh-ma-ra's tomb, the shoes are white, and have bindings of red and blue, and in some cases are delicately embroidered. Such examples as the shoe on an ivory figure found at Knossos and the terra-cotta model of a shoe found at Sitia show the daintiness with which the Minoans indulged themselves in the matter of footwear.

In personal adornment the men to some extent made up for their simplicity in the matter of dress. The Cup-Bearer wears a couple of thick bracelets on his upper arm and another, which bears an agate signet, on his wrist, and such decorations seem to have been in common use. The King, whose figure in low relief has been reconstructed from fragments found at Knossos, wears peacock plumes upon his head, while round his neck he has a collar of fleurs-

de-lis, wrought, no doubt, in precious metal.

The Minoan women are depicted with a perfectly white skin, which contrasts strongly with the bronzed hue of the men. The deep copperly tint of the men and the dead white skin of the women is, of course, to be accepted only as a convention, similar to that adopted by Egyptian artists, meant to express a difference of complexion caused by greater or less exposure to the weather; and we need not imagine that there was so great a contrast between the coloring of men and women in actual life as would appear from the paintings.

If the dress of the male portion of the populace was simple, that of the female was the reverse. An elaborate and tight-fitting bodice, cut excessively low at the neck, covered, or affected to cover, the upper part of the body, which is so wasp-waisted as to suggest universal tight-lacing. From the broad belt hung down bell-shaped skirts, sometimes flounced throughout their whole length, sometimes richly embroidered, as in the case of a votive skirt represented in faïence among the belongings of the Snake Goddess found in the Temple Repositories.

In some cases—*e. g.,* that of the votaress of the Snake Goddess—the skirt, below a small panier or apron, is composed of different colored materials combined in a chequer pattern distantly resembling tartan. A fresco from Hagia Triada represents a curious and elaborate form of dress, consisting apparently of wide trousers of blue material dotted with red crosses on a light ground and most wonderfully frilled and vandyked. Diaphanous material was sometimes used for part of the covering of the upper part of the body, as in the case of some of the figures from the Knossos frescoes.

Hairdressing, as already noticed, was very elaborate, and above the wonderful erections of curls and ringlets which crowned their heads the Minoan ladies, if one may judge from the Petsofa figurines, wore hats of quite modern type, and fairly comparable in size even with those of the present day (see pp. 13-14).

A seal from Mycenæ, representing three ladies adorned with accordeon-plaited skirts, shows that heels of a fair height were sometimes worn on the shoes.

Necklaces, bracelets, and other articles of adornment were in general use, and the workmanship of some of the surviving specimens is astonishingly fine.

Altogether, so far as can be estimated from the representations which have come down to us, the appearance of a Minoan assembly would, to a modern eye, seem curiously mixed. The men would fit in with our ideas of their period, but the women would remind us more of a European gathering of the mid-nineteenth century.

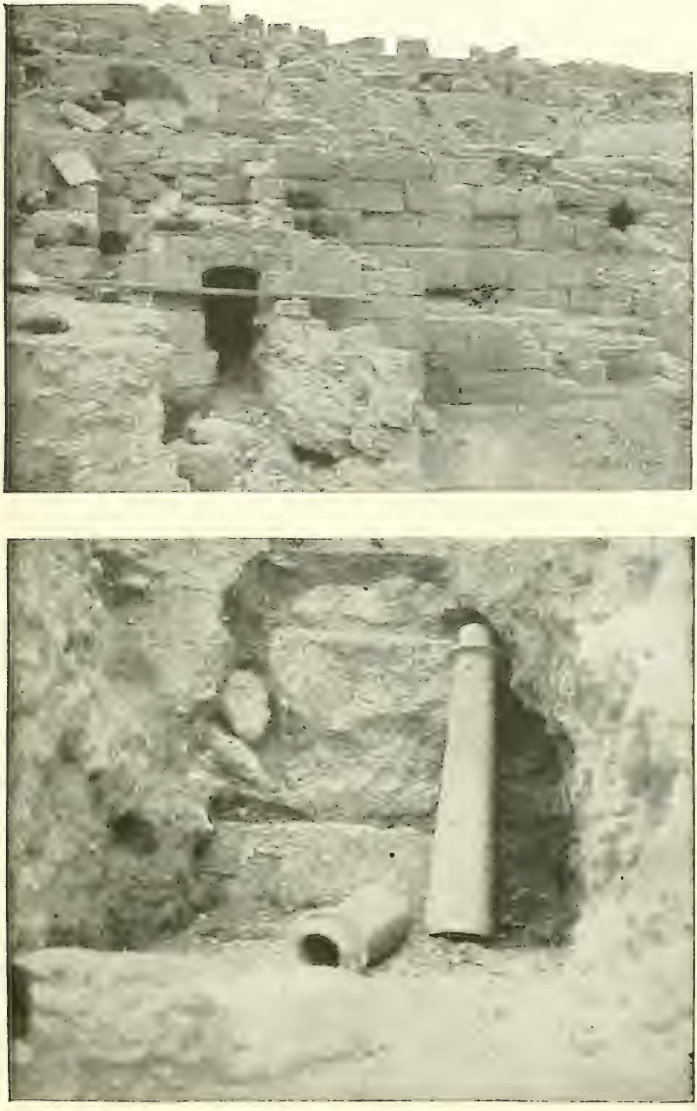
THE HOUSES WERE ALSO MODERN IN APPEARANCE

The houses which were occupied by these modern-looking ladies and their mates were unexpectedly unlike anything in the house-building of the classical period. There is little of the uniformity of style and arrangement which characterizes the ordinary Greek house. The Minoan burgher built his home as the requirements of his site and of his household suggested, and was not the slave of any fixed convention in the matter of plan.

The houses at Gournia, Palaikastro, and Zakro, which may be taken as typical specimens of ordinary Minoan domestic architecture, must have been much more like modern houses than anything that we know of in Greek towns of the classical period; and the elevations of Minoan villas preserved in the faïence plaques from the chest at Knossos suggest the frontages of a suburban avenue.

Some of the Knossian plaques show houses of three and four stories, with windows filled in with a red material which, as Dr. Evans suggests, may have been oiled and tinted parchment.

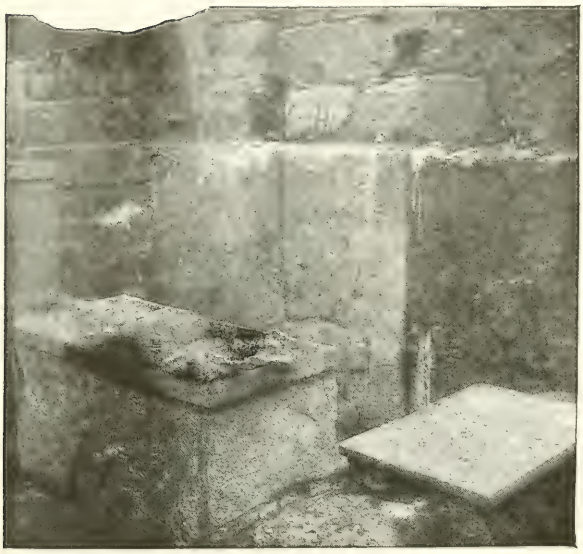
In such houses, as distinguished from the palaces, there was no separation between the apartments of men and women. The fabric of the houses was generally of sun-dried brick, reared upon lower walls of stone. Some of the



MAIN DRAIN: KNOSSOS

TERRA-COTTA DRAIN-PIPES, 3,500 YEARS OLD

"The hydraulic science of the Minoan architects is wonderful in the completeness with which it provided for even the smallest details. On a staircase, . . . lest the steepness of the gradient should allow the water to descend too rapidly and flood the pavement below, the runnel is so constructed that the water follows a series of parabolic curves, and the rapidity of its fall is thus checked by friction" (see pages 11 and 12).



A BATHROOM IN THE PALACE OF KNOSSOS

Knossian villas, however, were plastered and timbered, the round beam-ends showing in the frontage. Oblong windows took the place of the light-wells which give indirect illumination to the palace rooms. The accommodation must have been fairly extensive. The smaller houses have six to eight rooms, the larger ones twice that number; while one of the houses in Palaikastro has no fewer than 23 rooms.

Within doors the walls were finished with smooth plaster and probably decorated with painting, though of course on an humbler scale than in the palaces. The floors were of flagstones and cement, even in the upper stories, and in some cases of cobbles or of earth rammed hard.

The furniture of the rooms has perished, except in the case of such articles as were of stone or plaster; but the evidence we possess of the comfort and even the luxury of the life of these times in other respects suggests that the townsfolk of Gournia and the other Cretan towns were not lacking in any of the essentials of a comfortable home life. The great chest at Knossos, which was once decorated with the faïence plaques, was of course part of the furnishing of a royal home, and we are not to suppose that such magnificent pieces of furniture were common; but in their own fashion the ordinary Minoan houses were doubtless quite adequately appointed, and the great variety of domestic utensils which has survived shows that life in the Bronze Age homes of Crete was by no means a thing of primitive and rough-and-ready simplicity, but was well and carefully organized in its details.

It has been remarked that "cooking in Homer is monotonous, because no one eats anything but roast meat"; but this accusation could not be brought against the Minoans, who had evidently attained to a considerable skill and variety in the way in which they prepared their viands for the table. The three-legged copper pot, which was the most common vessel for cooking purposes, was supplemented by stew-pans with condensing lids and a variety of other forms of sauce-pans, while the number of different types of perforated vessels for straining and other purposes shows the care with which the art of cooking was attended to. Probably the Minoan kitchen, though we are still much in the dark as to its form, was almost as well equipped for its special functions as the kitchen of the present day.

Even at this exceedingly early stage of human progress the various branches of industry had become fairly separated and specialized—more so, perhaps, than in the Homeric period—and a considerable variety of tools was employed in the various crafts. The carpenter was evidently a highly skilled craftsman, and the tools which have survived show the variety of work which he undertook.

A whole carpenter's kit lay concealed in a cranny of a Gournia house, left behind in the owner's hurried flight when the town was attacked and burned. He used saws long and short; heavy chisels for stone and light for wood; awls, nails, files, and axes much battered by use; and, what is very important to note, they resemble in shape the tools of today so

closely that they furnish one of the strongest links between the first great civilization of Europe and our own. Such tools were, of course, of bronze.

Probably the chief industry of the island was the manufacture and export of olive oil. The palace of Knossos has its room of the olive press and its conduit for conveying the product of the press to the place where it was to be stored for use, and probably many of the great jars now in the magazines were used for the storage of this indispensable article.

LIFE EVIDENTLY WAS DEMOCRATIC

Of the social life of the people in these prehistoric times we know practically nothing. Only one inference, possibly precarious enough, may be made from one of the features of the architecture of Knossos. There is no attempt to seclude the life of the palace from that of the town and country around it. On the contrary, the building seems almost to have been arranged with the view of affording the citizens of the Minoan Empire every facility for intercourse with the royal household. The great West Court, with its portico and its seats along the palace wall, suggests considerable freedom of access for the populace to the immediate neighborhood of royalty.

It is perhaps rather a large inference to conclude that "the very architecture of the palaces of Knossos and Phæstos may testify to the power of the democracy," but at least the thoughtfulness with which the comfort of the people visiting the palace was provided for and the general openness and lack of any jealous seclusion, testified to by the whole style of the buildings, suggest that the relations between the kings of the house of Minos and their subjects were much more human and pleasant than those obtaining in most ancient kingdoms.

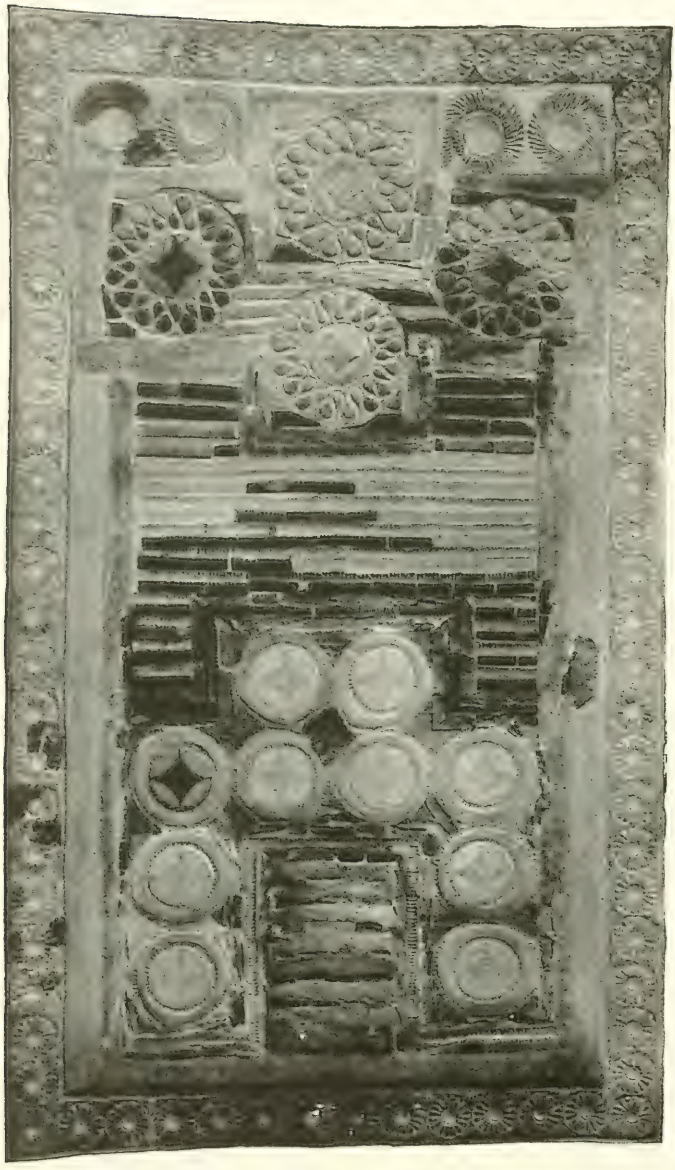
From their art one would, on the whole, conclude the people to have been a somewhat attractive race, frankly enjoying the more pleasant aspects of life and capable of a keen delight in all the beauties of nature. Minoan art has little that is somber about it; it is redolent of the open air and the free ocean, and a people who so rejoiced in natural beauty and delighted to surround themselves with their own reproductions and interpretations of it can scarcely have been bowed beneath a heavy yoke of servitude or have lived other than a comparatively free and independent life.

How much the Greeks of the classic period imbibed of the spirit of this gifted and artistic race we can only imagine. The artistic standpoint of the Hellenic Greek is somewhat different from that of his Minoan or Mycenæan forerunner, and he has lost that keen feeling for nature which is so conspicuous in the work of the earlier stock; but the two races are at least at one in that profound love of beauty which is the dominant characteristic of the Greek nature, and it may well be that something of that feeling formed part of the heritage which the conqueror took over from the conquered, and which, added to the virility and intellectual power of the northern race, made the historic Greek the most brilliant type of humanity that the world has ever seen.

THE GREAT PALACE WAS NOT FORTIFIED

The main entrance of the palace at Knossos seemingly lay on the north side, where the road from the harbor, now Candia, 3½ miles distant, ran up to the gates. Here was the one and only trace of fortification discovered in all the excavations. The entrance passage was a stone gangway, on the northwest side of which stood a great bastion with a guard-room and sally-port—a slender apology for defense in the case of a prize so vast and tempting as the palace of Knossos. Obviously the bastion, with its trifling accommodation for an insignificant guard, was never meant to defend the palace against numerous assailants or a set siege; it could only have been sufficient to protect it against the sudden raid of a handful of pirates sweeping up from the port.

How was it that so great and rich a structure came to be left thus practically defenseless? The mainland palaces of the Mycenæan age at Tiryns and Mycenæ are, so to speak, buried in fortifications.



THE KING'S GAMING-BOARD (SEE PAGES 8-9)

Their vast walls, 57 feet thick in some parts at Tiryns, 46 feet at Mycenæ, towering still, after so many centuries of ruin, to a height of 24½ feet in the case of the smaller citadel, and of 56 feet at the great stronghold of Agamemnon; their massive gateways, and the ingenious devices by which the assailant was obliged to subject himself in his approach to a destructive fire on his unshielded side—everything about them points to a land and a time in which life and property were continually exposed to the dangers of war, and the only security was to be found within the gates of an impregnable stronghold.

But Knossos, far richer, far more splendid than either Tiryns or Mycenæ, lies virtually unguarded, its spacious courts and pillared porticoes open on every side. Plainly the Minoan kings lived in a land where peace was the rule and where no enemy was expected to break rudely in upon their luxurious calm. And the reason for their confidence and security is not far to seek, if we remember the statements of Thucydides and Herodotus.

"The first king known to us by tradition as having established a navy is Minos," says the great Athenian historian. The Minoan Empire, like our own, rested upon sea power. Its great kings were the sea-kings of the ancient world, the first sea-kings known to history — over-lords of the Ægean long before the grave Tyrian trader had learned "the way of a ship in the sea" or the land-loving Egyptian had ventured his timid squadrons, at the command of a great queen, so far as Punt.

And so the fortifications of their capital and palace were not of the huge gypsum blocks which they knew so well how to handle and work. They were the wooden walls, the long, low, black galleys, with the vermilion bows and the square sail and the greeping rows of oars, that lay moored or beached at the mouth of the Kairatos River, or cruised

around the island coast, keeping the Minoan peace of the Ægean.

THE MINOANS WERE NOT WARLIKE

So long as the war-fleet of Minos was in being, Knossos needed no fortifications. No expedition of any size could force a landing on the island. If the crew of a chance pirate galley, desperate with hunger or tempted by reports of the wealth of the great palace, succeeded in eluding the vigilance of the Minoan cruisers and made a swift rush up from the coast, there was the bastion with its armed guard, enough to deal with the handful of men who could be detached for such a dare-devil enterprise. But in the fleet of Knossos was her fate, and if once the fleet failed she had no second line of defense on which to rely against any serious attack. There is every evidence that the fleet did fail at last (see page 22).

So far as the evidence goes, the Minoan Empire does not appear to have been a specially warlike one. No doubt there was a good deal of fighting in its history, as was the case with all ancient empires; but the insular position of Crete and the predominance which the Minoan navy established on the sea saved the island empire from the necessity of becoming a great military power, and the absence of spirit of militarism is reflected in the national art.

While an Assyrian palace would have been decorated from end to end with pictures of barbarous bloodshed and plunder, while even the milder Egyptians would have adorned their walls with records of the conquests of their Pharaohs, the kings of the house of Minos turned to other and more gentle scenes for the decoration of their homes. Flower-gatherers and dancing-girls, harvest festivals and religious processions, appealed to their minds far more than the endless and monotonous succession of horrors with which the Mesopotamian monarchs delighted to disfigure their walls; and even the sangers of the bull-ring, as seen on the Knossian frescoes, are mild and gentle when compared with the abominations where Teumman has his head sawed off with a short dagger and other unfortunates are flayed alive or have their tongues torn out.

The archives of the palace at Knossos certainly show that a military force was kept on foot and was thoroughly organized and well looked after. There are records of numbers of chariots, and of the issue of equipments to the charioteers of the force; and many of the tablets refer to stores of lances, swords, bows, and arrows, a store of nearly 9,000 arrows being mentioned in one of the finds, while an actual magazine containing hundreds of bronze arrow-heads has been discovered.

We may remember that in ancient warfare the Cretan bowmen were as famous as the Balearic slingers or the archers of England. On the whole, however, the genius of the Minoans, like our own, was more commercial than military, though no doubt they were not devoid of the fighting spirit when occasion arose. Their kinsmen of Mycenæ and Tiryns, less happily situated, were forced to develop the military side of life; but the position and the maritime power of Crete secured for the fortunate island those long centuries of tranquil growth which were so fruitful in the arts of peace.

A TERRIBLE CATASTROPHE SUDDENLY OVERWHELMED THE EMPIRE

Probably the power and grandeur of the Minoan Empire was never more imposing than during the hundred years before 1400 B. C. The house of Minos at Knossos had reached its full development, and stood in all its splendor, an imposing mass of buildings crowning the hill of Kephala, with its five stories, around the great central court, its theatral area, and its outlying dependencies. Within its spacious porticoes and corridors the walls glowed with the brilliant colors of innumerable frescoes and reliefs in colored plaster. The cup-bearer, the queen's procession, the miniature frescoes of the palace sports, stood out in all their freshness. Magnificent urns in painted pottery, with reliefs like those of the great papyrus vase, decorated the halls and courts, and were rivaled by huge stone amphoræ, exquisitely carved.

THE HARVESTER VASE: HAGIA TRIADA

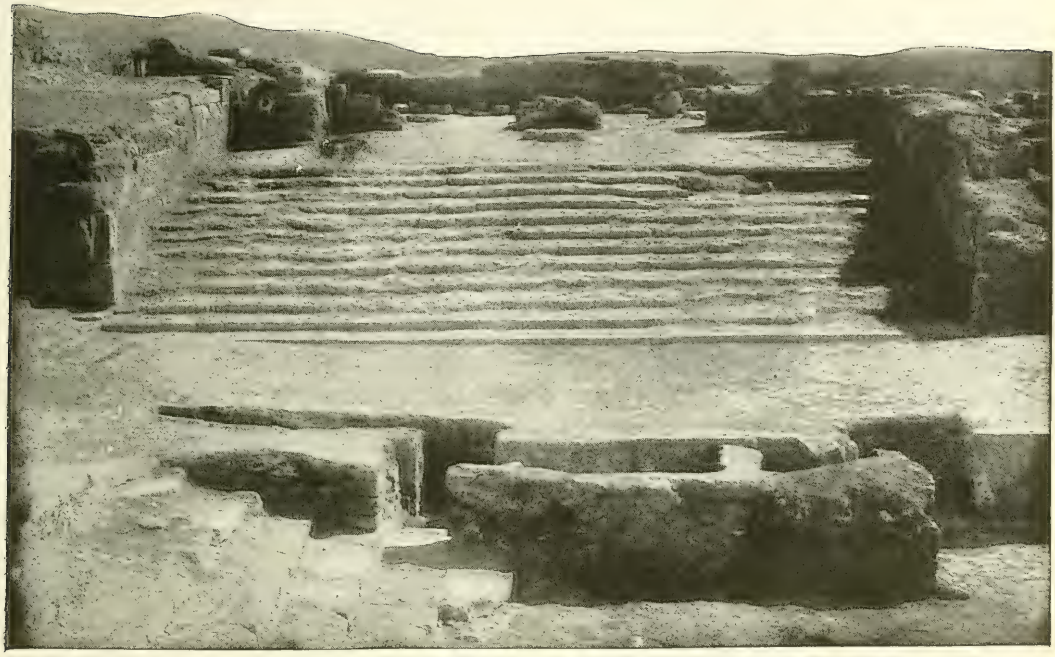
The king and his courtiers were served in costly vessels of gold, silver, and bronze *repoussé* work. The empire of the sea-kings was at its apogee, and on every hand there were the evidences of security and luxury.

But, as in the contemporary Egypt of Amenhotep III, a similar development in all the comforts and luxuries of civilized life was swiftly followed by the downfall under Akhenaten, so in Crete the luxury of the late Minoan II was only the prelude to its great and final disaster. Exactly when the catastrophe came we cannot tell.

That there was a huge disaster about 1400 B. C. which broke forever the power of the sea-kings is unmistakable. The Minoan kingdom did not fall from over-ripeness and decay, as was the case with so many other empires. The latest relics of its art before the catastrophe show no signs of decadence; the latest specimens of its linear writing show a marked advance on those of preceding periods.

A civilization in full strength and growth was suddenly and fatally arrested. Everywhere throughout the palace at Knossos there are traces of a vast conflagration. The charred ends of beams and pillars, the very preservation of the clay tablets with their enigmatic records, a preservation due probably to the tremendous heat to which they were exposed by the furious blazing of the oil in the stone jars of the magazines, the traces of the blackening of fire upon the walls—everything tells of an overwhelming tragedy.

Nor was the catastrophe the result of an accident. There is no mistaking the significance of the fact that in the palace scarcely a trace of precious metal, and next to no trace of bronze, has been discovered. Fire at Knossos was accom-



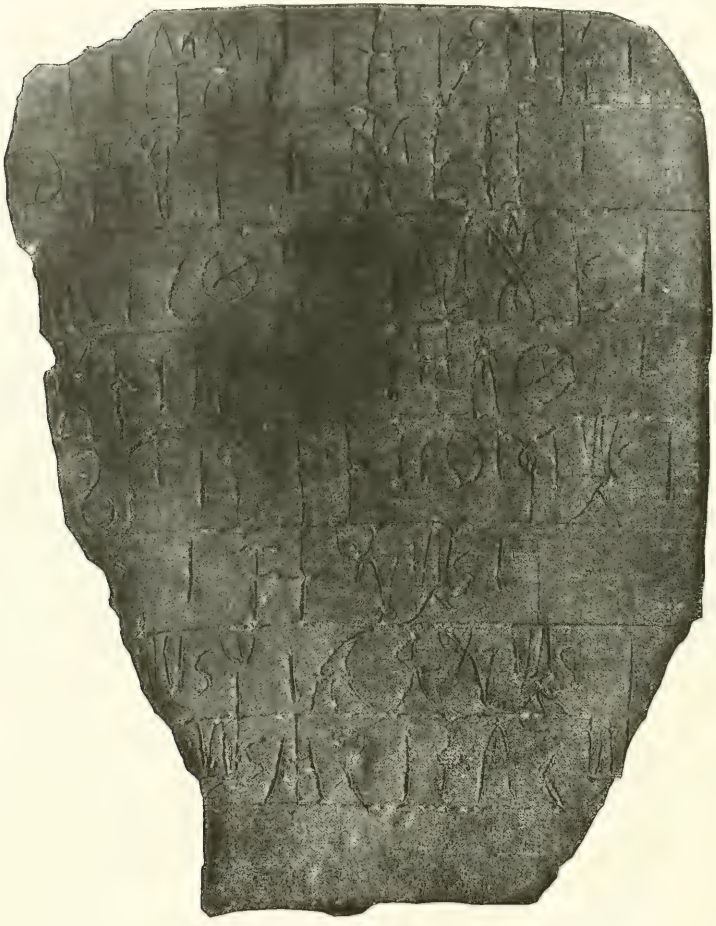
GREAT STAIRCASE: PHÆSTOS, CRETE

The chief glory of the palace at Phæstos is the great flight of steps, 45 feet in width, which formed its state entrance, the broadest and most splendid staircase that ever a royal palace had. "No architect," says Mosso, "has ever made such a flight of steps out of Crete." . . . The palaces of Knossos and Phæstos wonderfully resemble each other in the general ideas that determine their structure, though, of course, there are many variations in detail. But, as contrasted with the sister palace, the stately building at Phæstos has exhibited a most extraordinary dearth of the objects of art which formed so great a part of the treasures of Knossos.

panied by plunder, and the plundering was thorough. A few scraps of gold leaf, and the little deposit of bronze vessels that had been preserved from the plunderers by the fact that the floor of the room in which they were found had sunk in the ruin of the conflagration, are evidences, better than absolute barrenness would have been, to the fact that the place was pillaged with minute thoroughness, and the unfinished stone jar in the sculptor's workshop tells its own tale of a sudden summons from peaceful and happy toil to the stern realities of warfare.

The evidences from Phæstos and Hagia Triada tallies with that from Knossos. Everywhere there are the traces of fire on the walls and a sudden interruption of quiet and luxurious life. The very stone lamps still stand in the rooms at Hagia Triada, and on the stairs of the Basilica and Knossos, as they stood to lighten the last night of the doomed Minoans.

Of course there are no records, and if there were we could not read them; but it is easy to imagine the disastrous sea fight off the coast; the wrecks of the once invincible Minoan fleet driven ashore in hopeless ruin in the shallow bay, like the Athenian fleet at Syracuse; the swift march of the mainland conquerors up the valley; the brief, des-



ONE OF THE THOUSAND CLAY TABLETS WITH LINEAR SCRIPT FOUND AT KNOSSOS, CRETE, BY DR. A. J. EVANS

Of all the discoveries yet made on Cretan soil, that which, in the end, will doubtless prove to be of the greatest importance is the discovery of the various systems of writing which the Minoans successively devised and used. Photo from "The Sea Kings of Crete," by Rev. James Baikie. Adam and Charles Black, publishers (see pages 7 and 8).

perate resistance of the palace guards, and then the horrors of the sack, and the long column of flushed victors winding down to their ships laden with booty, and driving with them crowds of captive women. Similar scenes must have been enacted at Phæstos and Hagia Triada, either by other forces of invaders or by the same host sweeping round the island.

From this overwhelming disaster the Minoan Empire never recovered. The palace at Knossos was never reoccupied as a palace, at least on anything like the

scale of its former magnificence. The invaders possibly departed as swiftly as they had come; or if, as seems more probable, they eventually established themselves as a ruling caste among the subject Minoans, they chose for their dwellings other sites than those of the old palaces. The broken fragments of the Minoan race crept back after the sack to the blackened ruins of their holy and beautiful house, not to rebuild it, but to divide its stately rooms and those of its dependencies by rude walls into poor dwelling-houses, where they lived on—a very different life from that of the golden days before the sack.

THE QUILLS OF A PORCUPINE

By Frederick V. Coville

THE pôrcupine is an animal quiet and inoffensive in his own pursuits, but powerful in the means of his defense and terrible in his use of it against his chief enemy, the dog.

Carper and I were hunting coyotes and bears in the backwoods of Oregon. There were seven dogs in our pack. They had been specially selected and trained to hunt bear. Two were pure-bred foxhounds, whose part it was to find the trail and lead the pack on it unerringly by their marvelous keenness of scent. Nig, the old one, was scarred and partly crippled from encounters with bear. Rover, two years old, though with less experience, was in the prime of activity, keenness, and endurance. Ranger, the staghound, was tall and strong and, when the game was in sight, very swift. In the open he could catch and kill a coyote. Tige, the bloodhound, was the heaviest of the pack. His nose was keen, and on a bear trail he was true and tireless, and savage in the operations at the finish. In other game he had less interest, and when he slept he growled and dreamed of bear hunts. Jule was a mixed bloodhound and bulldog, and Bounce and Drum were her two yearling pups, one yellow, the other brindle.

For two hours one morning we had followed the dogs without picking up a fresh trail. We were passing from an open ridge into a forest of fir and pine when the young foxhound, first sniffing excitedly with his nose to the ground, raised the coarse hair between his shoulders, bayed sharply, and plunged into the timber. The other dogs closed in behind and disappeared.

Carper tore after them through the brush, scaling the slippery logs without danger by means of his spiked lumberman's shoes, and I followed as best I could. Approaching a little opening in the timber, I heard the sound of a general fight, Carper yelling, cursing, and kicking among the dogs, then a rifle shot, and then another. When I burst through the chaparral Carper was still yelling and kicking the dogs away from the carcass of a porcupine, grazed by his first bullet and plowed open by the second. "Well," said he, "we are in for it now."

The porcupine had taken a position beneath a log that was raised a little above the ground. As the dogs attacked him he turned and struck them terrific blows in the face with his short clubbed tail, almost as muscular as a gorilla's arm, and at every stroke he left a mark like a cushionful of barbed needles. Dogs less fierce would have quit sooner and suffered less, but that bunch of bear-dogs had behind them a thousand years of the fiery passion of the slayer. The dogs that could reach the porcupine bit him in the back and tail till mouth and tongue were a bloody, quivering mass of barbs. Only by the fiercest onslaught on the dogs themselves had Carper been able to open them up so that he could shoot the porcupine.

The dogs were now pawing their faces and plowing their noses along the ground in agony, breaking off some of the quills at the surface and driving the barbed

Photo by Frederick V. Coville

PHOTOGRAPH OF THE STAGHOUND "RANGER," FROM WHOSE FACE AND HEAD WE EXTRACTED 600 QUILLS AFTER HIS FIGHT WITH THE PORCUPINE

(SEE PAGE 31)

Photo from U. S. Forest Service

SOME OF THE PACK OF DOGS WHICH ATTACKED THE PORCUPINE WITH SUCH DISASTROUS RESULTS: WALLOWA NATIONAL FOREST, OREGON

This photograph shows Forest Service hunter J. K. Carper coming to camp with the hide of a grizzly bear that he had killed near the scene of the fight, while patrolling the coyote-proof sheep pasture.

points deeper into the flesh. The old dogs, who had been through similar experiences before, would come up and allow the quills to be pulled out as long as they could stand the pain, and then break away to paw and plow again.

When the few superficial quills had been removed the real work of saving the dogs' lives began. We took off our coats, set our guns against a tree, and went at the task. One by one the dogs were caught. Sitting upon the animal's crouching body, Carper held the head between his knees, gripping ear and jaw in his powerful grasp, while I pulled out the quills.

The main part of a porcupine quill is smooth and white and has the tough, flexible texture of the quill of a bird's feather, but for a distance of about half an inch from the needle-sharp point the quill is hard, black, slender, and armed with innumerable barbs. The quills vary greatly in length, thickness, and amount of barbing, the shorter and stouter ones having the longest points and most effective barbs, the larger, thinner quills gradually merging into the long, coarse hairs of the animal's pelt.

A long-pointed quill with the barbed portion fully imbedded in the nose of a dog often resisted the strongest pull that either of us could give, notwithstanding an excellent hold on the body of the quill between the thumb and the bent forefinger. The pain must have been intense. The most resistant quills were pulled either by the teeth or by improvised pliers made of a half-split stick, in the crack of which the quill was caught and tightly held.

I was assured afterward by an old woodsman that an imbedded quill could be removed more easily and with less

Photo from U. S. Forest Service

BAND OF EWES AND LAMBS AT THE END OF A SUMMER'S GRAZING IN A COYOTE-PROOF PASTURE: WALLOWA NATIONAL FOREST

Note the fat condition and contented appearance of the sheep after a summer's freedom from the fear of wild animals and the worry of herder and sheep dogs

Photo from U. S. Forest Service

SMALL BUNCH OF THE PASTURED BAND OF EWES AND LAMBS: COYOTE-PROOF PASTURE, WALLOWA NATIONAL FOREST

At the close of the season the lambs were nine pounds heavier than the same class of lambs from bands that were herded on the same kind of land outside the pasture

Photo from U. S. Forest Service

A FOREST-SERVICE HUNTER, J. K. CARPER, AT HOME, SHOWING A FEW SKINS OF SOME OF THE LARGE PREDATORY ANIMALS KILLED OUTSIDE THE FENCE OF THE COYOTE-PROOF PASTURE: WALLOWA NATIONAL FOREST, OREGON

pain by rolling it between the thumb and finger as it is pulled. To use his expression, the barbed point would "unscrew." A minute examination of a quill-point did not show any spiral arrangement of the barbs, but it did show that the barbs are not rigid, but flexible, and I have no doubt that by twisting as described the barbs would be bent to one side and the quill be much more easily withdrawn.

The dogs varied in the manner in which they took their punishment. The yellow pup and the young foxhound had only a few quills, and they howled when these were pulled. The old foxhound was hard to hold and was inclined to be ugly. Jule complained, but allowed the pulling to proceed, although her jaws were reeking with blood and saliva. Drum, the brindle pup, showed his bulldog stock by submitting to the long ordeal with barely a whimper.

The two big dogs—Tige, the bloodhound, and Ranger, the staghound—were a problem. Either was strong enough, if he was so inclined, to break Carper's hold, and the staghound, furthermore, had offered to bite his master. He was in by far the most serious condition of any of the dogs. He had more quills in his face than any other, and some were near, though fortunately not in, his eyes. They were liable at any time to work there, however, through his agonized pawing. We considered shooting him to end his misery, but Carper hated to do it. We concluded to go back to camp, get something to eat, and decide the dog's fate afterward.

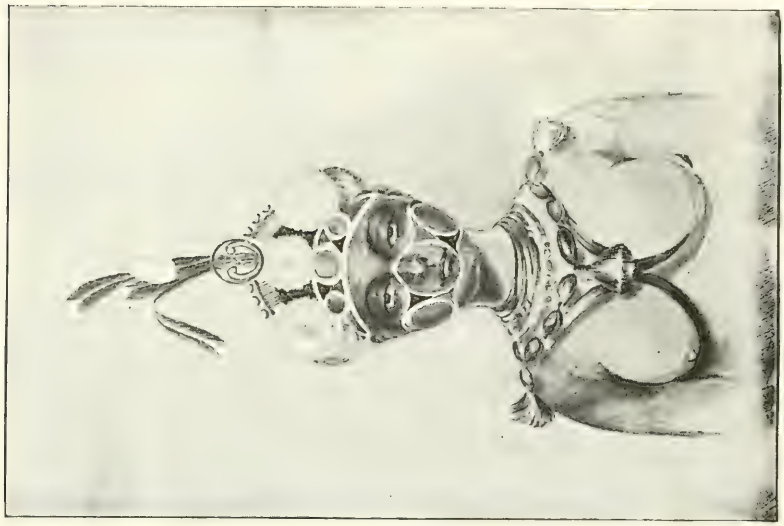
On the way back I asked Carper whether the dogs would not learn to let a porcupine alone. He replied that they would not; that the older dogs had been through the experience repeatedly, though he had never seen a pack quite so thoroughly done up, and that if they ran across a porcupine the next day they would undoubtedly tackle him. Evidently dogs of this fighting quality are no more deterred by such an experience than is a bulldog deterred from fighting a second time because he has once before been bitten in a fight.

After our meal we took the remaining quills out of Tige. Those on the outside of his head Carper pulled alone. The great bloodhound wagged his tail after each pull; I could not tell whether out of gratitude to his master, or because he thought the two were engaged in some sort of game, rough and painful, but nevertheless to be treated good-naturedly. The quills within his mouth were taken out with a pair of steel pliers while two men held him, a stout stick of wood between his jaws as a precaution against biting.

The staghound we decided to give a chance for his life, though neither of us relished the prospect of lacerating his head to do it. His face was beginning to swell and he was dozy until we stirred him up. He was ready to fight us all. We tied him down under a log, and one man held his body, the other his head, while I pulled the quills with the steel pliers.

By actual count we took 568 quills out of that staghound. Eighty-one of these were inside the line of his teeth, in his gums, the roof of his mouth, and his tongue. At least 30 had been pulled out at odd times before the count began, and during the following days over 20 more worked out of his misshapen head at various points. It was not a nice or a pleasant task, and the repulsive details of quill-pulling have already been sufficiently explicit. The staghound lived and fortunately lost neither eye.

It was a curious and a fearful weapon that nature had given to this otherwise weak and peaceable porcupine, with which in defense of his liberty and his life he dealt a terrible retribution to seven powerful enemies, half of whom he would have killed had not still greater odds been matched against him.



Photos by P. A. Talbot, from the Geographical Journal of London

EKOI GIRLS IN "FATTING-HOUSE" COSTUME

NOTES ON THE EKOI

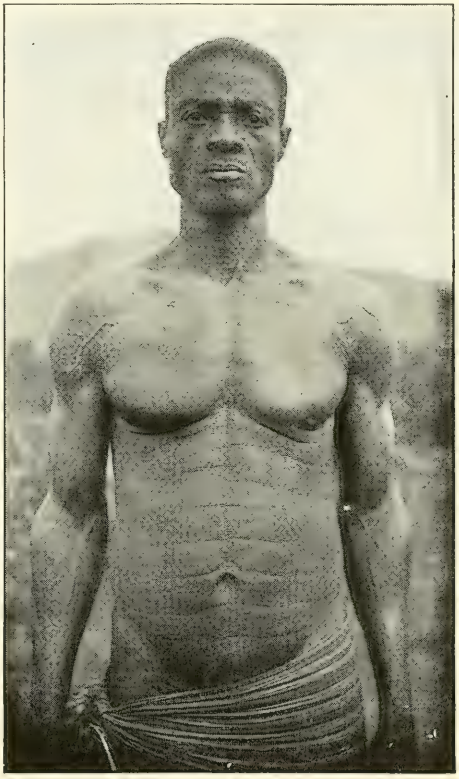
By P. A. Talbot

THE Ekoi, of extreme southern Nigeria, on the Equator, should be, and probably are, among the happiest people on earth, for they have no taxes to pay, no wearisome restrictions to undergo, and so fruitful is the land that a few weeks' labor is enough to supply them with food, home, and clothes for a whole year.

The Ekoi are devoted parents, but it will take years of patient teaching before they grasp the importance of fresh air and the simplest sanitary measures for the health of their little ones.

They have curious beliefs as to the advent and death of their babes. One charming superstition forbids all quarreling in a house where there are little children. The latter, so they say, love sweet words, kind looks, and gentle voices, and if these are not to be found in the family into which they have reincarnated, they will close their eyes and forsake the earth till a chance offers to return again amid less quarrelsome surroundings.

At the new year, and on all great festivals, the chief "societies" of men, women, and children come up to the station to give a series of dances. To the Ekoi, dancing is one of the main occupations of life. With them the dance provides an outlet both for the dramatic instinct and for religious fervor. In all



Photos by P. A. Talbot, from the Geographical Journal of London

EKOI GIRL ATTENDANT ON JUJU "IMAGE" TYPE OF EKOI

(SEE PAGE 34)

"Egbo plays" the chief character, or "image," as it is called, is dressed to represent the "Egbo" itself.

It is the habit of the Egbo Club, at certain times of the year, to take the sacred images and other paraphernalia to a part of the bush where a little hut of green boughs has been built to receive them. Sentries are then posted to keep all intruders from coming within a mile of this spot. On one occasion two young girls, sisters, happened to have missed the patrol and have trespassed unwittingly within the sacred precincts, probably in search of nuts or bush fruits, which abound everywhere. They were caught by the sentries, brought before the "Egbo," condemned to death, and hanged almost immediately.

Their brother, who was a member of the highest grade of the society, was allowed, as a great favor, to be present at their death and afterwards to carry home the bodies to his family. Of redress, in such a case, there could be neither hope nor even thought.

The Egbo "image," of which each company has at least one, is a figure robed from crown to heel in a long garment pierced with eye-holes (see page 35). It usually bears on its head a wooden framework covered with skin and shaped like a human head, often with two eyes, looking both ways—into the future and back to the past—the symbol of the omniscience of the deity. This curious apparition runs up and down, generally accompanied by two attendants clothed in gorgeous close-fitting knitted garments, usually of red, yellow, and white.

Soon after my arrival information was brought that something of an unusual nature was happening in Oban. On investigation it appeared that a certain chief had fallen under the suspicion of having, in the guise of a were-leopard, killed several cows and goats. Preparations were on foot for ridding the town of him in a summary manner when the arrival of the "white man" put an end to the proceedings of the *ex tempore* tribunal. Chief Agbashan, a splendid hunter, is believed to have the power of transforming himself into an elephant—an accomplishment that would certainly be of great use to him when out after these creatures.

An old woman of Oban, named Awaw Ita, was suspected of a still more sinister familiar. Her husband had a sore on his ankle. Somehow or other the idea got about that this could not heal because a snake came out of her mouth to lick the wound every night while they slept. The case came into court, as the "Egbo Society" had tried and sentenced the woman, which of course they had no right to do. Curiously enough, as in similar cases in our own country during the Middle Ages, she herself firmly believed in the truth of the story, and owned to it when she thought that such a confession might cost her her life.

At a small place nestling at the base of beautiful purple hills, on one occasion the children gave a particularly charming series of games, singing all the while in the pretty lilting way usual among them. Nothing could be more graceful than the waving arms and swaying limbs of the little brown forms as they bent and moved, always in perfect time to their song. The musical faculty of this people is certainly wonderful, though developed along peculiar lines. During the whole period spent among them I have never heard a false note nor found a dancer or accompanist one fraction of a second out of time.

At the little village of Niaji the only attempt at portrait modeling known in this part of the world is to be seen. It represents Maia, priestess of Nimm. The figure, modeled, rudely enough, in mud on a framework of sticks, is seated above the grave of the woman it commemorates. Over her the frame of a tiny hut has been built, and round this are hung most of the things used by the dead woman in her life—all broken, according to the funeral custom of the race. No man is allowed to share in the mysteries of Nimm, though a woman is sometimes, though rarely, chosen as the head of "Jujus," in which both sexes share.

Not even the fear of death would induce a male Ekoi to intrude at the celebration of the women's rites. Should a woman think that she has any cause of

EGBO HOUSE AND JUJU TREES (SEE PAGES 34 AND 37)

Photos by P. A. Talbot, from the Geographical Journal of London

AN EKOI HUNTING JUJU

This is the great "hunting Juju" of the Ekoi, and has never before appeared to a European. The "image" was supposed to be deaf to human voices, and to hear only those of the bush beasts, save when awakened by the call of the trumpet. It is the Juju that is supposed to have the power of "smelling out" all others, and carries an axe in its jaws as a sign of its special fierceness. Powerful as it is, however, it was not proof against the very human weakness of wishing to have its photograph taken, and appeared, on this inducement, among its less exclusive brothers.

EKOI GIRL WITH NSIBIDI WRITING ON FACE

ONE OF THE MANY MODES OF EKOI COIFFURE

Photos by P. A. Talbot, from the Geographical Journal of London

complaint against a man, she brings her grievance before the head-woman of her society, who is usually a priestess of Nimm. The latter then calls a meeting, and, if the complaint is thought justified, steps are taken to bring the offender to a sense of his duty. The Ekoi are a polygamous people, but the chief wife, not the husband, is the head of the house. Each wife has control over her children, who almost invariably go with her if she leaves her husband, and her rights as to property are most strictly safeguarded by native law.

In an article such as this there is necessarily no room to give an idea of the richness and beauty of folklore among this people, who have legends to explain practically all their customs and beliefs. Perhaps, however, it is allowable to quote one short story, which, though far below the level of Ekoi legends in point of style, explains more clearly than would be possible in any other way the position which woman holds in this country.

"At the beginning of things," so the legend runs, "the world was peopled by women only. One day the earth-god, Awbassi Nsi, happened by accident to kill a woman. On hearing this, the rest gathered together and prayed that, if he meant to slay them, he would bring destruction on all together, rather than kill them one by one. Awbassi was sorry for the grief that he had caused; so he offered to give them anything they should choose out of all his possessions to make up to them for their fellow-woman, whom he had slain. They begged him to mention what he had to give, and said that they would all cry 'Yes' when he named the thing which they wished to have. Awbassi began and mentioned one by one all his fruits, fowls, and beasts, but at each they shouted 'No.'

"At length the list was nearly ended; only one thing remained to offer. 'Will you, then, take a man?' asked Awbassi, at last.

"'Yes,' they roared, in a great shout, and, catching hold of one another, started dancing for joy at the thought of the gift which Awbassi was sending.

"They took man, therefore, as compensation for the fellow-woman whom they had lost. Thus men became the servants of women, and have to work for them up to this day, for though a woman comes under the influence of her husband on marriage, yet she is his proprietor, and has a right to ask any service and expect him to do whatever she chooses."

The religious observances of the Ekoi are altogether a fascinating study. Beneath many modern corruptions and disfigurements are yet to be found traces of an older, purer form of worship—traces which carry us back to the oldest-known Minoan civilization and link the belief of the modern Ekoi with that of the ancient Phœnician, the Egyptian, the Roman, and the Greek. In some ways, indeed, the Ekoi form may be termed the most ancient of all, for whereas in the oldest-known representations of Minoan bird and tree worship the tree has become almost entirely conventionalized into pillar shape, and later on becomes a mere pedestal to support the bird, among the Ekoi it still keeps its original form—that of the actual living tree.

The smallest town has its juju tree. There are many varieties of these, but each stands alone, usually in the open space before the Egbo house. They are generally bound round with tie-tie or surrounded by a little fence festooned with linked rings of the same. On the branches of these trees hang countless nests of one kind or another of the weaver bird. Even the smallest child knows that these are sacred, for on them depends the prosperity of the town.

Should the birds be injured or driven away, the women would become barren and even the cattle cease to bear. Surely in this form we have the oldest picturing of the wedding of earth and sky—sky father and earth mother—for of all created things the bird is most akin to air and sky, while the tree, with its roots in the dark ground, is the best and oldest personification of mother earth. In the course of ages, strangely enough, mother earth has become father earth for the Ekoi, whose two principal deities are now Awbassi Awsaw, the sky god, and the earth god, Awbassi Nsi. Enough legends and fragments of ritual,

however, have been collected to show that the older idea has not yet died out.

Everywhere in the bush grow giant trees, often over 200 feet in height and from 80 to 100 feet in girth. Perhaps the most noticeable of these are the cotton trees, the smooth bark and straight shafts of which give them the appearance of giant columns, on which the blue sky rests like a dome. These forest giants are objects of veneration among Efik and Ekoi alike, and well it is to propitiate the genii of the trees, lest the latter open and imprison the unwary wayfarer, like Ariel on the island of Prospero.

In the whole country there are no open spaces, save those which have been cleared as sites for villages or farms. The Ekoi spend their whole lives in the twilight of the beautiful, mysterious bush, peopled to their fancy not by wild animals alone, of which they have no fear, but by were-lopards and all kinds of terrible half-human shapes, and by the genii of trees, rocks, and rivers. Here more truly even than in old Greece the terror of Pan is everywhere. This atmosphere of twilight and mystery explains the grafting of juju and fetish worship onto the purer and more ancient forms of religion. So far as can be traced, the Ekoi have steadily trekked down from the north, for the site of each new town is to the south of the former one.

One hears from certain sources of the hardships entailed on the natives in the making of the splendid roads, by means of which the British administration is opening up their tropical and luxuriant "bush" district. No one, however, is quicker than the natives themselves to see the advantages to be gained from such improved means of communication, whether as regards personal safety or trading facilities. On several occasions towns have offered, of their own free will, to do more than had been asked of them. In some cases they have even made a new piece of road on their own initiative as a surprise for my next visit to their part of the country.

Another point often raised by those who have no practical experience of natives is the hardship entailed on the latter by engaging them as carriers. Perhaps I may mention here that it is a usual thing for bands of men to come in from a distance of 40 to 50 miles, a month beforehand, in order to make sure of being taken on as carriers for the next bush tour.

OUR IMMIGRATION LAWS FROM THE VIEWPOINT OF NATIONAL EUGENICS

By Prof. Robert DeC. Ward, of Harvard University

HOW far do our present immigration laws enable us to exclude those aliens who are physically, mentally, and morally undesirable for parenthood; those whose coming here will tend to produce an inferior rather than a superior American race; those who, in other words, are eugenically unfit for race culture? We, in the United States, have an opportunity which is unique in history for the practice of eugenic principles. Our country was founded and developed by picked men and women, and today, by selecting our immigrants through proper legislation, we have the power to pick out the best specimens of each race to be the parents of our future citizens.

The social responsibility which rests upon this country in this matter is overwhelming. We may decide upon what merits—physical, intellectual, or moral—the fathers and mothers of American children shall be selected; but we have left the choice almost altogether to the selfish interests, which do not care whether we want the immigrants they bring, or whether the immigrants will

be the better for coming. Steamship agents and brokers all over Europe and eastern Asia are today deciding for us the character of the American race of the future.

It is no argument against practicing eugenic ideas, in the selection of our alien immigrants, to say that the New England country towns are full of hopelessly degenerate native Americans, who are inferior, mentally, morally, physically, to the sturdy peasants of Europe. The degeneracy of our country native stock is probably chiefly due to the drawing off of the stronger and more capable men and women to the cities; to prolonged inbreeding, and to the continued reproduction of feeble-mindedness, which is rife in many of our country districts. It will not help to reduce the number of our native degenerates if we admit alien degenerates. National eugenics, for us, means the prevention of the breeding of the unfit native, as well as the prevention of the immigration and of the breeding after admission of the unfit alien.

CAREFUL ABOUT IMPORTING CATTLE, CARELESS ABOUT IMPORTING MAN

Should we not exercise at least the same care in admitting human beings that we are now exercising in relation to animals, to insect pests, or to disease germs? Yet it is actually true that we are today taking more pains to see that a Hereford bull or a Southdown ewe, imported for the improvement of our cattle, are sound and free from disease than we take in the admission of an alien man or woman who will be the father and mother of American children. We do not hesitate to prohibit the importation of cattle from a foreign country where a serious cattle disease is prevalent. It is only in very extreme cases, indeed, that we have ever taken such a step in connection with the importation of aliens. Yet there are certain parts of Europe from which no aliens should be allowed to enter this country, for reasons which are eugenically of the first importance.

Our present laws aim to exclude some twenty-one classes of mentally, physically, morally, and economically undesirable aliens. On paper the list of the excluded classes is long and formidable, and seems more than sufficient to accomplish our eugenic purposes; but the fact is that careful and unprejudiced students of immigration agree that these laws do not keep out the unfit so as to preserve the *status quo,* to say nothing of promoting eugenic improvement. We already have an army of probably not less than 150,000 feeble-minded in the United States, of whom only about 10 per cent are in institutions, the rest being free to propagate their kind. And of those in institutions, the large proportion are kept there only temporarily, being at liberty for much of the time during their reproduction period.

The same is true of thousands of criminals, whom we shut up for varying periods of time, but allow, in the intervals when they are out of prison, to populate the world with children, much of whose inheritance is criminal. We are today legalizing the begetting of criminal children by failing to give permanent custodial care to habitual criminals.

Further, there are over 150,000 insane in the institutions of the United States alone, and of these many have already left offspring to perpetuate their insanity. In spite of this appalling situation—appalling from the standpoint of mere sentiment and of mere philanthropy—doubly appalling from the standpoint of eugenics, we have been admitting alien insane and alien imbeciles, and alien epileptics and alien criminals, partly because of a lax administration of the law under former administrations, partly because the law is incapable, under existing conditions, of effective enforcement. The disproportionate increase of alien insane, of alien imbeciles, of alien criminals, and many other facts which may be ascertained by any person who is interested in this question, shows that, as just stated, our immigration laws do not now enable us to preserve the *status quo.*

Sir Francis Galton has clearly shown that "each married degenerate produces on the average one child who is as degenerate as himself or herself, and others in whom the taint is latent, but liable to appear in a succeeding generation."

Further, it is well known that imbeciles have larger families than normal persons, and that they also have a large number of illegitimate children. Parenthood on the part of all these classes of persons, native or alien, is a crime against the future. To admit to this country the feeble-minded, the insane, the epileptic, the habitual criminal, those afflicted with hereditary diseases, is no less a crime against the future.

The ideal selection of our immigrants would be possible only if we could have a fairly complete history, running back a few generations, showing the hereditary tendencies of each alien. This is impracticable, so far as the immediate future is concerned. But there are some things we can do. We can insist that each alien, on landing here, should undergo a very thorough mental and physical examination at the hands of our Public Health and Marine Hospital Service surgeons. These examinations would involve the stripping to the skin of each alien; the usual physical examination for physical defects; mental tests; tests for syphilis, and similar precautions. Is this too much to demand when the welfare of the human race is at stake?

I have seen thousands of aliens landed, and I have marveled at the skill with which our surgeons are now able, by the most superficial examination as the aliens file by, at the rate of several a minute, to detect some of the physical and even some of the mental defects which put these aliens into one or another of the classes which may be excluded. But such a superficial examination is all wrong.

It is nothing short of a crime to admit people, as often happens in a rush season, at the rate of 3,000, 4,000, or 5,000 in one day at Ellis Island. On April 11, 1910, 7,931 immigrants were inspected by the medical officers. Think of that! And these medical officers were supposed to detect any mental and physical defect which might exclude!

I believe that we ought to limit the number of aliens who shall be landed in one day to a certain number which could reasonably well be carefully inspected. We ought largely to increase the number of the surgeons detailed for that most important work of inspecting arriving aliens. We ought to enlarge the accommodations at some of our immigrant stations, in order that this work might be properly carried out.

Again, we can go a long way toward the accomplishment of our object by increasing the fines which the steamship companies now pay when they bring over an alien who is found, on our own examination here, to be an idiot, imbecile, epileptic, or suffering from a loathsome or dangerous contagious disease which could have been detected at the port of departure. The fine is now only $100. The steamship companies pay little attention to the provision. They run their chances of having such aliens detected on landing, and in some cases they insure themselves against possible loss by obliging the alien to deposit $100 when he buys his ticket. Now if we increased this fine to $500—and that is none too large—the steamship companies would themselves, without expense to us, make a much more thorough examination abroad before sailing.

Further, for the more effective detection of aliens who are physically, mentally, and morally undesirable, and who are already enumerated in our list of classes excluded by existing law, we should put immigrant inspectors and our own surgeons on board of all immigrant-carrying vessels. These officials, mingling with the immigrants on the voyage over, should see that they are properly treated and cared for; that they are not overcrowded, and that they receive adequate medical attention.

But, of far greater importance than that, these officials would be able to detect a great many cases of physical and of mental defect which we could not possibly detect in our necessarily hurried examination when these people land, and in this way we should be able to exclude and to send back far larger numbers of undesirable aliens than is at present possible, however strictly we may try to enforce the law.

In addition to these steps which we should take, and take instantly, to accomplish the more effective exclusion of the insane, the imbecile, the idiot, the tuberculous, and those afflicted with loathsome or dangerous contagious dis-

eases, we ought to amend our laws so that it will be possible to exclude more aliens of such low vitality and poor physique that they are eugenically undesirable for parenthood. The law of 1907 excludes persons "who are found to be and are certified by the examining surgeon as being mentally or physically defective, such mental or physical defect being of a nature which may affect the ability of such alien to earn a living." This clause has been found to be rather ineffective, partly because it has been taken to be an economic test and not a physical one; partly because of other provisions in the same act which largely nullify this section by making it possible to admit on bonds aliens who fall into the group here named.

Now aliens of such low vitality, poor physique, or suffering from such mental or physical defect that their ability to earn a living is thereby interfered with are, in the majority of cases, highly undesirable persons. They are not only themselves weaklings and unlikely to resist disease, but they are likely to have defective and degenerate children. Bonds will not prevent them from breeding.

We constantly speak of the need of more "hands" to do our labor. We forget that we are importing, not "hands" alone, but bodies, also. The vast majority of incoming alien immigrants are potential fathers and mothers, and the character of the race that is to be born depends upon the kind of alien bodies which we are allowing to have landed on our shores day by day. It is a tremendous responsibility which rests upon us.

Conservation of our natural resources: how much we hear about that. Conservation of American forests is important. So is conservation of American coal, and oil, and natural gas, and water supply, and fisheries. But the conservation and improvement of the American race is vastly more important than all other conservation. The real wealth of a nation is the quality of its people. Of what value are endless acres of forests, millions of tons of coal, and billions of gallons of water if the race is not virile, and sane, and sound?

Fearfully misguided has been most of our so-called philanthropy. We have housed and clothed and fed the defective, the degenerate, the delinquent, to such an extent that we have encouraged them to reproduce their kind in ever-growing numbers. We have spent increasing sums for asylums, almshouses, prisons, and hospitals, in which we have temporarily confined the insane, the pauper, the habitual criminal, the imbecile, leaving them free, during most of their lives, to propagate their kind. It is a fact, disguise it as we will, that we have taxed ourselves to support institutions which have resulted in increasing and not decreasing the number of the unfit.

We have before us an immediate duty of tremendous importance in caring for our own unfit; in seeing to it, by adequate legislation, that the insane, the habitual criminal, the feeble-minded, and similar classes are permanently segregated, so that they cannot reproduce their kind to be a further burden upon the nation, and in enacting laws which shall prevent the marriage of those whose offspring will be unfit.

But, in addition to our own very heavy burden of those who are defective or degenerate, we are adding every year, by immigration, many hundreds if not thousands of aliens whose presence here will inevitably result, because of their own defects or those of their offspring, in lowering the physical and mental and moral standards of the American race.

Biologists admit that they have much to learn about heredity. But of some things we are already sure. Enough is known to make it absolutely essential, if the quality of the American race is to be preserved, that there should be a far more careful selection of our incoming alien immigrants, on eugenic grounds, than we have ever attempted.

The need is imperative for applying eugenic principles in much of our legislation. But the greatest, the most logical, the most effective step that we can take is to begin with a proper eugenic selection of the incoming alien millions. If we, in our generation, take these steps, we shall earn the gratitude of millions of those who will come after us, for we shall have begun the real conservation of the American race.

VIEW OF CONSTANTINOPLE: THE NATURAL ADVANTAGES OF ITS SITE MAKE IT THE QUEEN CITY OF EUROPE

THE YOUNG TURK *

By Rear-Admiral Colby M. Chester, U. S. Navy

DURING the better part of the past four years I have resided in Constantinople, making trips to the interior of Turkey, the islands of the Ægean Sea, Egypt, and several of the lost colonies of the Empire.

I have dined in the palace of that arch-fiend the recent noted ruler of the Turkish Empire, Abdul Hamid; also in some of the homes of prominent Turks, and I feel warranted, therefore, in speaking of them from the standpoint of one who has known them at close range.

During the early part of the year 1908 the growing discontent with the existing régime in the Ottoman Empire on the part of all the different races of this very cosmopolitan country—Turks, Greeks, Armenians, Bulgarians, and Arabs—aroused a cry of distress that was heard throughout all christendom. From outside the boundaries of Turkey, among the western nations of Europe, Christian people pressed their administrators for a declaration that should either put an end to the despotic rule of Abdul Hamid—the Nero of the age—or drive the Turk out of Europe.

Suddenly from Saloniki, in the south of Macedonia, Enver Bey and Niazi Bey, two young Turkish army officers of never-dying fame, raised the standard of revolution, and a wave of reform was started from within the Empire itself that spread from border to border with lightning rapidity.

It was on July 4, 1908, the birthday of the United States of America and of republican government, that a new era was inaugurated in Turkey. It took a number of days to organize the rebellious subjects of the Sultan, after these young officers had lighted the fuse which was eventually to blow this despotic ruler from his throne; so that it was not until an ultimatum wired to Constantinople demanding the proclamation of the constitution was received and acted upon that it was finally granted to the people.

On July 24, however, Abdul Hamid, learning that his last remaining support, the Albanian troops, whom he had for many years bribed to sustain his tottering power, had deserted him, and that the threat to march on Constantinople with 200,000 men was to be literally carried into effect, submitted to the inevitable and signed the *iradé* that was to make him a figure-head in governmental administration.

WHO ARE THE YOUNG TURKS?

The term "Young Turk" is applied to that vast class of Moslem subjects who were disaffected by the growing burdens placed upon them by the despotic action of the ruling power. This term applies alike to young and old, male or female; those who lived in Turkey or were spread broadcast over the face of the earth by expatriation or the fear of death by residence in the fatherland. This so-called Young Turk party comprised Christians and Jews, as well as Turks, and embraced parts of all the various races which go to make up the nation.

The "Committee of Union and Progress" was a secret society organized within the kingdom, the ranks of which were recruited from the Young Turk party. Members were obliged to take a most sacred oath to devote their whole energies to the redemption of the country, to obey every order given through the channels of the society, never to reveal its secrets, and to kill any person, however near and dear to them, whom the committee might condemn to suffer death. The harshness of this creed was due to the necessity of fighting with fire the devil who ruled the nation, and who had organized the most diabolical espionage system ever conceived—a system that created suspicion between man and wife, brother and sister, or even mother

* An address to the National Geographic Society, December 8, 1911.

MOSQUE OF SULTAN ACHMET I AT CONSTANTINOPLE

The only mosque, except the Kaaba at Mecca, possessing six minarets. Note the spiral column enclosed with a rail in the right foreground. This is the famous "Serpent of Delphi," consisting of three brass serpents twined around each other, and one of the most historic monuments in existence. It was constructed by the Greeks who defeated the Persian hordes at Platæa (479 B. C.), and dedicated to Apollo at Delphi. Upon it are inscribed the names of the immortal Greek cities that drove the Persians out of Europe. It was brought from Delphi to Constantinople by Constan-

INTERIOR OF THE MOSQUE OF SULTAN ACHMET I, THE MOST BEAUTIFUL MOSQUES IN CONSTANTINOPLE

"The mosques are the noblest, worthiest monuments of the Ottomans. With a care which they have never expended on kiosk or palace, and with an art which found in such constructions its deepest inspiration and loftiest destiny, they have sought to make their mosques as sublime and lasting as the human mind could devise and the human hand could execute. Like the classic Greeks, they have consecrated their best to the service of their faith."—Edwin A. Grosvenor in "Constantinople."

INTERIOR COURT OF THE MOSQUE OF SULTAN ACHMET I

At the feasts which follow the Mohammedan Ramazan (or fasting) the courts of this grand mosque are thronged with thousands of children

and child, lest an indiscreet word should bring death from the edict of the despot whose bloody sword was ever suspended over his trembling subjects.

No member of this committee was ever permitted to know more than four others. Five was the maximum number allowed to meet together in a single group; but the secret chain leading up to the central figure or group, which was all supreme, was so carefully concealed that no one to this day has been able to discover the ultimate source of that wonderful power.

No one who has not been an eye-witness to the effect of both the old and new régimes in Turkey upon its people can realize the change that now took place.

RETURN OF THE EXILES

The announcement that constitutional government had been granted to Turkey soon spread to all parts of the world; aged exiles and those who had fled from the dread machinations of Abdul Hamid returned and filled the capital to its utmost capacity; and as they were all members of the Young Turk party, the power that this remarkable secret organization wielded over the people became the prime factor in the administration of the government.

The people of the nation, who were at first stunned by the suddenness of the change, began to shout the new word "liberty," which had just entered their vocabulary, with all the changes that could be played upon it, and in every quarter of the Empire celebrations took place, the inhabitants simply going wild with joy for their deliverance from slavery.

Addresses were made by Mohammedan and Christian speakers in streets, in squares, in mosques, and in churches. Fraternity became for the first time the sentiment which seemed to bind all creeds, races, and tongues together in harmonious accord. Moslem and Christian leaders embraced and kissed each other in public, while tears rolled down the cheeks of thousands as they took part in the festivities.

Burial services were performed for the Armenian martyrs of 1896, which were taken part in by Mohammedans and Christians alike. Crowds of former conflicting religious sects formed vast parades, led by their priests; and, although the followers of Islam greatly exceeded all other sects in numbers, Christian fathers were invariably given the seat of honor in the carriages which accompanied them.

All looked to the Committee of Union and Progress for guidance, and these men worked with great circumspection. Abdul Hamid was distinctly told that as long as he ruled according to the constitution his life would be spared, but that he would be held to a strict accountability for his actions. He was, nevertheless, promptly put under surveillance to insure his good behavior. Naval vessels, which had been left to rot in the port, because this wily ruler feared that some one might do as he had done with the fleet, in making it the means to drive his own brother off the throne of Turkey, were put in commission and moved to an anchorage in the Bosphorus, where the guns bore directly on Yildiz, and thus the Sultan became practically a prisoner in his own palace.

PROMINENT PART PERFORMED BY AMERICANS

Americans little realize what an important influence their countrymen and countrywomen have exerted in bringing about constitutional government in Turkey. Talcott Williams, LL.D., in an address in Brooklyn, N. Y., October 15, 1908, stated: "Many causes have combined, many factors are present, many influences have turned the hearts of men in that Empire; but, if we ask ourselves what the governing and final factor is which has brought about the first of the world's bloodless revolutions, which has seen a people divided and dissevered by creed, by race, by language, by every conceivable difference which can separate the sons and daughters of men, suddenly act together, we do ill if we forget that for 80 years the American missionaries have been laying the foundations and preaching the doctrine which makes free government possible."

DANCE OF WHIRLING DERVISHES: CONSTANTINOPLE

"Each revolves not only upon himself, but around all the rest. Circle swings in intricate circle, and the relative position of each is in constant change throughout the hall. The long white robes, hanging to the feet, slowly distend by the rapid motion, and at last stand at right angles to the wearer. Yet, though the space is small and the participants are many, never does robe graze robe, nor hand collide with hand. . . . The pallid faces of the zealots seem transformed. On many a countenance dawns an expression of ecstasy, and all seem moving as if in a delicious dream. So the living labyrinth glides on for eighty or ninety minutes."—Edwin A. Grosvenor

INTERIOR OF THE TURBEH, OR MAUSOLEUM, ATTACHED TO THE MOSQUE OF YENI VALIDEH DJAMI (SEE PAGE 51)

The turbeh contains 56 catafalques of sultans, sultanas, and their children

THE DOVE MOSQUE, OR THE MOSQUE OF SULTAN BAYAZED II

It is called the Dove Mosque because of the thousands of doves that brood in every nook and cranny of the mosque. All these doves, tradition states, are descended from a single pair which a poor widow contributed while the mosque was building. As the Sultan Bayazed, the builder of the mosque, notoriously stinted his architect, while the widow gave her all, the doctors of Mussulman theology declare that her humble name, and not the Sultan's, shines in heaven as that of the real founder.

THE SPLENDID MOSQUE OF YENI VALIDEH DJAMI, "THE MOST ELEGANT MOSQUE WHICH EXISTS AT CONSTANTINOPLE"

It is built of white marble. Its interior is profusely decorated with intricate mosaics, mother of pearl, and precious tiles. "The scores of columns which sustain the galleries within were brought from the plain of Troy, and may have once been set up in temples named by Homer. One column, of such peculiar rose as is rarely seen, was brought as a trophy from Crete, in 1645, by the victorious Kapoudan Pasha Yousouf. This pasha was counted the handsomest man of his time. His beauty and the roseate marble could not save him; or, rather, they caused his death. A jealous rival accused him of having brought a worthless colored stone to the Sultan, while keeping a column of solid gold for himself. The luckless admiral was speedily deposed from office, and shortly sent to execution."—Edwin A. Grosvenor, in "Constantinople."

GUARD AT THE IMPERIAL BANK: CONSTANTINOPLE

The great educational system founded by these Americans comprises at present more than 300 common schools in the Empire, 44 high schools, 8 colleges, 1 normal school, and 5 divinity schools. This scholastic work is spread out all over this former "garden spot of the world," and has leavened the masses with high ideals of living, knowledge of free institutions, and longings for better government.

Such an authority as Gladstone has placed upon record a statement that "American missionaries in Turkey have done more good to the inhabitants of that country than has all Europe combined. And Mr. James Bryce, the British Ambassador to Washington, goes even further, and states: "I cannot mention the American missionaries without a tribute to the admirable work they have done. They have been the only good influence that has worked from abroad upon the Turkish Empire."

THE "UNSPEAKABLE TURK" NO LONGER EXISTS

It should not be forgotten that Turkey of today is not the Turkey depicted in our child's history, nor is it in fact the same country that it was three years ago. The people of Turkey as a body have long since passed from the pale of the "unspeakable Turk," and many of them stand out as the peers of any people in the world in general intelligence, character, and all the qualities that go to make good citizens; but of course as yet they are wanting in sufficient experience to guide without assistance the ship of state to the high plane at which they are aiming. This experience they are fast acquiring, and are already as far advanced in the practices of government by the people as were those of the United States at the end of the first decade in our history, having had our example to guide them.

During my stay among these people I have found men of sterling character and unswerving integrity—men well fitted to lead their country through crises similar to those through which our own nation passed in its struggle for birth.

While we Americans have done much toward the enlightenment of the Turk, I should say in all fairness to them that they have earnestly sought education through following the precepts of the Koran (their Bible), in which is combined the tenets of both religion and legislation. A short selection from this book, so often misinterpreted, will illustrate its teachings. It reads:

"The duty of every Mussulman is to acquire science.
Science is the life of the heart.
The learned shine in the world like stars in the sky.
Knowledge is the immortal soul of man."

THE TURKS ARE APT SCHOLARS

And that the Turks are apt scholars no one can doubt who has lived among them. One of the younger classmen of the Beirut American University presented me, when I was last there, with a copy of a speech made by Dr. Bliss, its president, on the responsibilities of popular government, which this young student had taken down stenographically and typewritten himself. This young man, a Syrian by birth, spoke English well, and more than a dozen other languages. Yet he was but an average scholar in the college.

At Constantinople on more than one occasion I have witnessed the presentation of some of Shakespeare's plays by the young women of the American College for Girls that would compare favorably with any similar representation in our own country. Many of the girls who took part in the plays were but 16 or 17 years of age, and had not studied the English language, in which the dramas were given, more than one year. There was no self-consciousness or stage fright among these girls, because they were actuated by a common desire to acquit themselves well without any regard to the effect made upon others.

The Turkish people are reaching out to other civilizations for help to recover from the tyranny and stagnation that has bound them so long in slavery. They look to America particularly as the one nation of the West that has no political ambition to subserve in its action toward

SELLERS OF VEGETABLES: CONSTANTINOPLE

Note the man on the left with a basket full of melons on his back. The man next to him has a basket of grapes

SELLERS OF "SIMITS": CONSTANTINOPLE

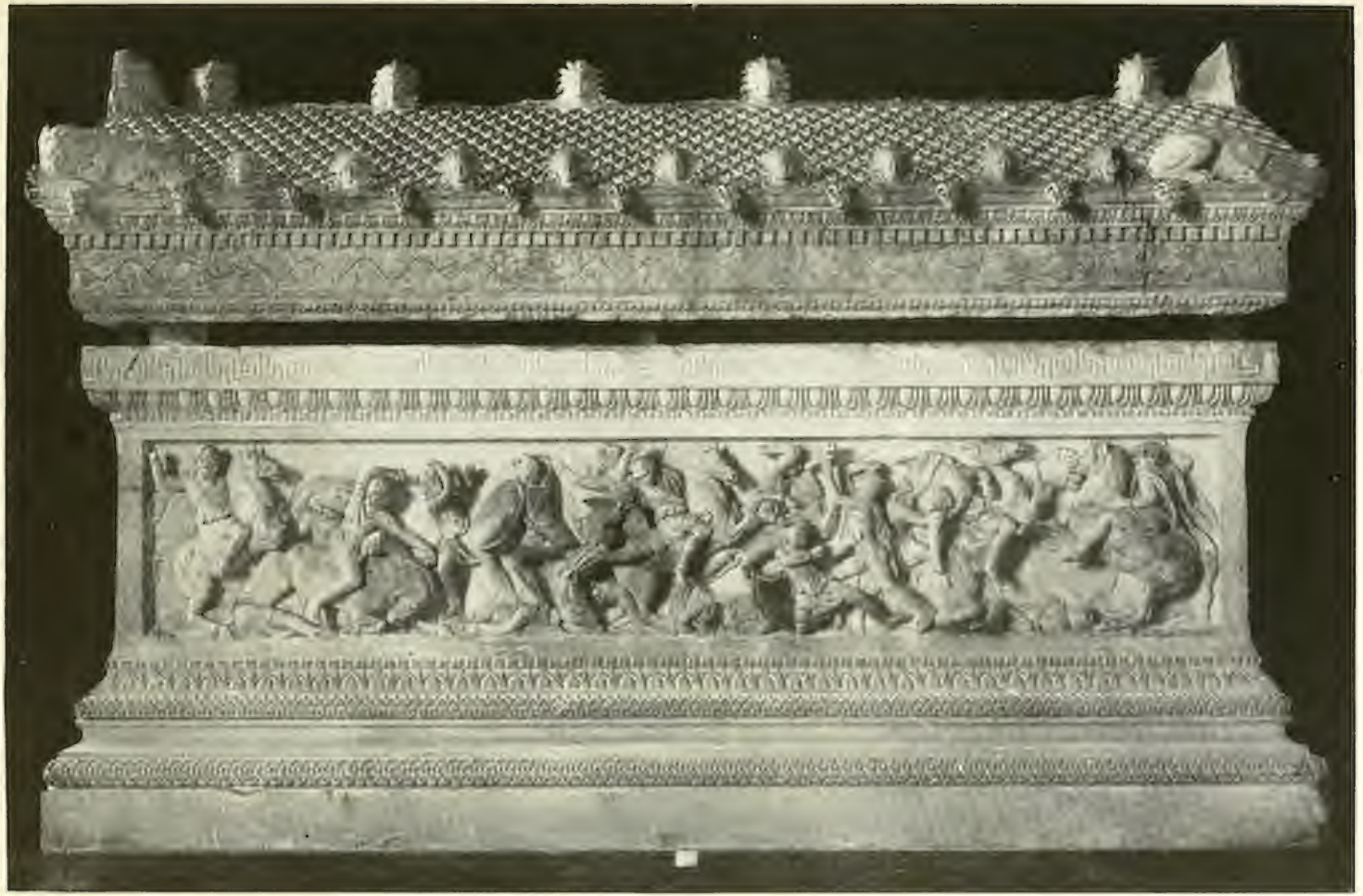
The round hoops or rings (simits) with which the stands are loaded resemble "pretzels." They are made of flour and water and are very popular among all classes

A SCENE IN THE GREAT TURKISH CEMETERY IN SCUTARI, ON THE BOSPORUS, PROBABLY THE VASTEST MUSSULMAN CEMETERY IN THE WORLD

The wilderness of tombs and the thousands of tall, motionless, funereal cypress trees make this cemetery one of the most impressive sights in the East

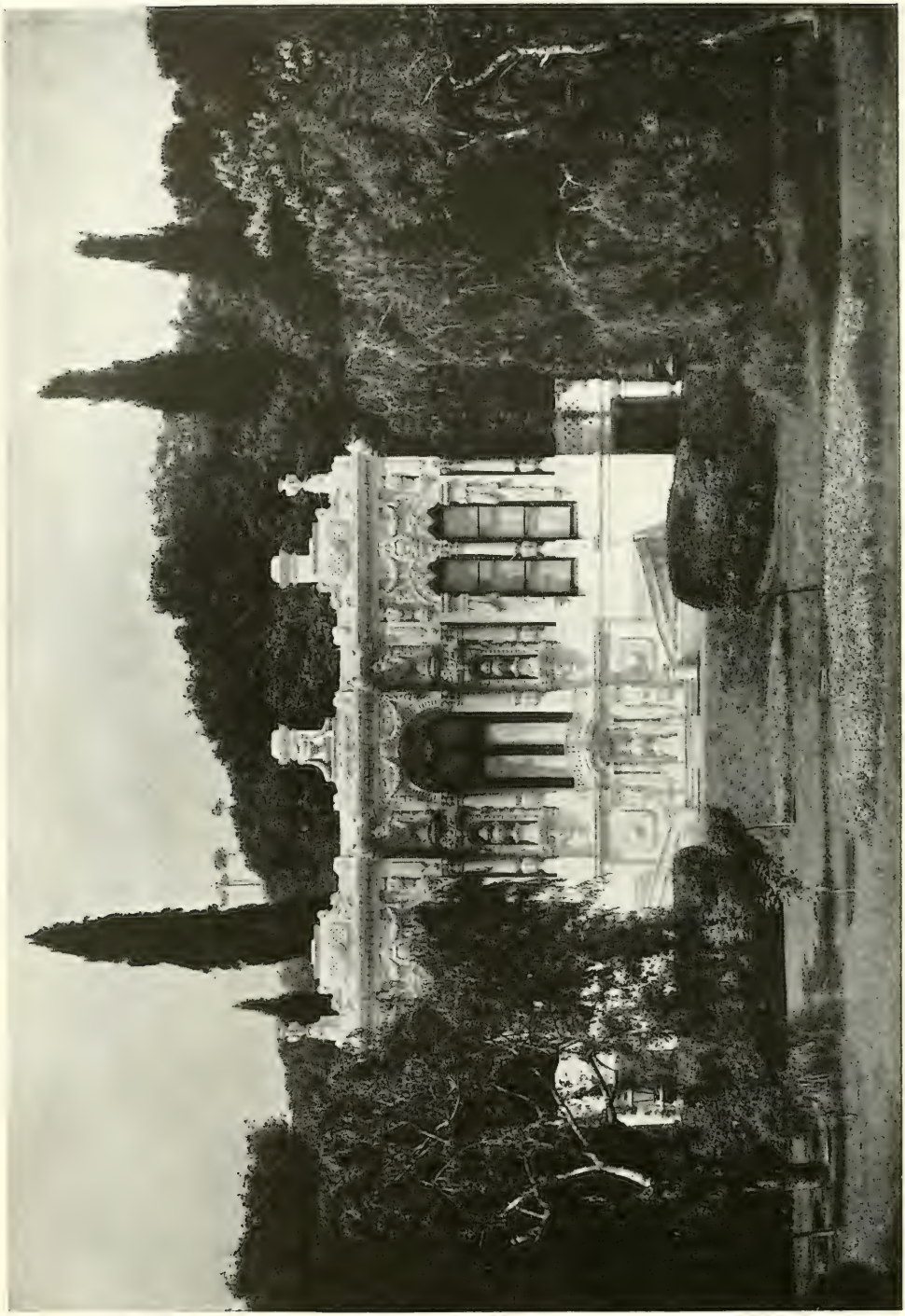
ANOTHER SCENE IN THE TURKISH CEMETERY OF SCUTARI, ON THE BOSPORUS

A CORNER IN THE TURBEH, OR MAUSOLEUM, OF YENI VALIDEH DJAMI: NOTE THE RICH AND ELABORATE DECORATION, SO CHARACTERISTIC OF OTTOMAN ARCHITECTURE (SEE PAGES 49 AND 51)



TOMB OF ALEXANDER THE GREAT, NOW IN THE MUSEUM AT CONSTANTINOPLE

It was discovered at Sidon by an American missionary, Dr. Eddy, many years ago. The Ottoman Empire is an exhaustless mine for the archæologist, as it was the seat of the Minoan, Chaldean, Hittite, Assyrian, Babylonian, and Hebrew empires



THE SULTAN'S RETREAT

them, and we should help them to work out their natural destiny for which we have already helped lay the foundation.

Sir William Ramsay has said: "Constantinople is the center about which the world's history revolves. It is the bridge that binds the East to the West, the old to the new civilization, which must be brought into harmony before the culmination of all civilization can appear, bringing 'Peace on earth and good-will toward men.'"

Sir William also says, in derogation of his own people: "The heated struggle between the English and Germans for influence in Constantinople has much impeded the establishment of peace and order in Turkey." Nothing truer has been said of the "near eastern question."

THE YOUNG TURKS HAVE ACCOMPLISHED MUCH

We have been told that the Young Turks have made a failure of constitutional government. Let us see how these abused people have acquitted themselves during the past three and one-half years, since the formation of democratic government in Turkey, as compared with the work of other nations.

A brief summary of the events occurring in this eventful epoch is necessary for a full understanding of the subject.

The storm of 1908 came so unexpectedly upon the political horizon of Europe that the powers were stunned for the moment. The sudden change of policy in the Turkish Empire, however, was too good an opportunity not to be taken advantage of, and on October 3, 1908, Austria-Hungary announced her annexation of the Turkish provinces, Bosnia and Herzegovina. This aggressive measure, being in absolute contravention of the Treaty of Berlin, made in 1878, at the end of the Russo-Turkish War, by the united powers of Europe, was the entering wedge for the despoliation of the Turkish Empire, which had long been threatened.

A mild protest was made to this act, as being a stab to the very heart of universal peace measures, in which the world at large was interested; but, as the leading protesting powers had been guilty of practically the same offense in times past, the effort to stay the act was without cohesion or force; and, as Austria-Hungary held the nine points of the law in her possession of the territory, over which that country had been granted suzerain powers under the Treaty of Berlin, and having, through an alliance with Germany, her great army at her back, the political conscience of the disgruntled parties was quickly healed by the bare hope of something good out of the wreckage coming to them.

Bulgaria now declared, and secured, her independence from Turkish rule, and thus the Empire was shorn of another considerable portion of its European territory. The Young Turks protested against this arbitrary move on the part of their now grown-up son, but the threatening attitude of the powers, coupled with a hope that this sacrifice would enable them to bind the remaining states of the Empire into a more cohesive union, led them to peaceably accept this declaration of Bulgaria's independence.

Russia, foreseeing no end to the carving of Turkey for other interests, thus begun, put in a claim for some of the spoils, which might have been hers but for the action of the "disinterested" powers in signing the Peace of Berlin.

Greece then claimed the island of Crete, over which she had been granted and held suzerain powers for 30 years, on the identical ground put forward by Austria-Hungary upon taking Bosnia and Herzegovina.

The Young Turks now rose up in their might and vowed that Turkey would fight to the death any further attempt to despoil her of territory, and so strongly was this threat, which was practically an ultimatum, backed by the sentiment of the whole Moslem race, that England, fearing for the peace of Europe, used her influence to postpone action on the claims of Russia and Greece. She practically promised, however, that their claim should be favorably considered at an opportune time in the near future.

This stopped for a while aggressive measures against Turkish territory and permitted the Young Turk party to take

A TURKISH PEASANT

"It should not be forgotten that Turkey of today is not the Turkey depicted in our child's history, nor is it in fact the same country that it was three years ago. The people of Turkey as a body have long since passed from the pale of the 'unspeakable Turk,' and many of them stand out as the peers of any people in the world in general intelligence, character, and all the qualities that go to make good citizens; but of course as yet they are wanting in sufficient experience to guide without assistance the ship of state to the high plane at which they are aiming" (see page 53).

TURKISH HOUSE IN CONSTANTINOPLE

Those who would know something about the human side of Turkish women are recommended to read "Behind Turkish Lattices," by Hester D. Jenkins (J. B. Lippincott, publishers). Miss Jenkins was for ten years a teacher in the American College for Girls at Constantinople.

A TURKISH CAFÉ IN CONSTANTINOPLE: THESE MEN ARE PORTERS, OR HAMALS, WHO CARRY HUGE LOADS ON THEIR BACKS

up the prosecution of reforms, so urgently needed in the Empire.

A REVOLUTION SPEEDILY CRUSHED

But for a few months only was peace allowed to reign in the near East. From out of a clear sky, on April 13, 1909, burst a war cloud that threatened to throw the country back into anarchy. Abdul Hamid had, with his characteristic cunning and a liberal supply of money, taken advantage of a mild dissension among the delegates in Parliament which had met in December of the preceding year, to instigate a mutiny in the army and navy stationed at the capital against constitutional authority. At the same time he sent emissaries to the interior of the country to appeal to the religious fanaticism of the poorer classes, and inaugurated a racial warfare between the Turks and Armenians that at once put constitutional government in jeopardy. It was evident that Abdul Hamid's main purpose in bringing about intestine strife was to show the powers that Turkey could only be ruled by his strong right arm and that he alone could put a stop to the conflict.

So near to success did he come in his nefarious aim that on April 24 the *London Times* published an article to the effect that constitutional government was dead, and that England should at once recognize Abdul Hamid as the supreme ruler of the land.

This conviction was so general among foreigners that a commission from Parliament was prevailed upon to warn the commander-in-chief of the Macedonian army, Mohammed Shefket Pasha, whose troops were then marching on the capital, that if his army entered the city it would bring about a massacre of Christians, and then would follow European intervention. "Go back," said this Oliver Cromwell of his country to the parliamentary committee sent to communicate this information, "and attend to your parliamentary duties. There is no power under heaven that can keep my army out of the city." And so it proved.

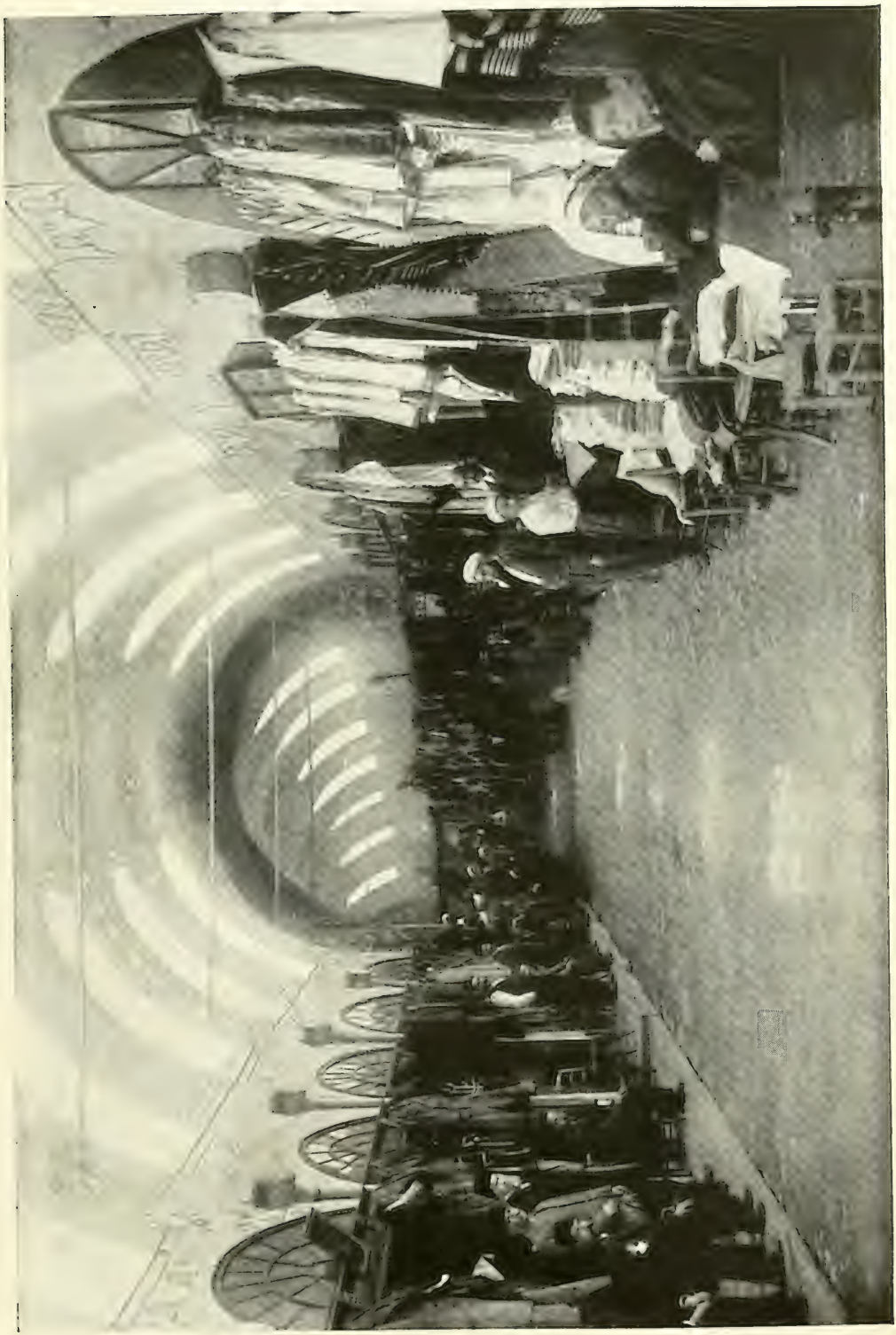
All military authorities unite in saying that the taking of Constantinople by the constitutional army, April 26, 1909, was one of the most brilliant and successful campaigns in history. It is not necessary to describe it here; but, as far as the safety of Christians, the bugbear of Turkey's foes, is concerned, I can state that ladies of my party traversed the streets of Constantinople while the conflict was raging with as little danger and less fear than they would have had in crossing Broadway, in New York city, during an election day excitement.

The spectacle of Shefket Pasha's grand army of 30,000 as fine a body of men as ever crossed a parade ground, augmented by a contingent of volunteers, containing among the private soldiers peers of the realm and officers of high rank, both of the army and the navy, for whom there were not suitable commands, taking possession of Constantinople was an inspiration long to be remembered. It was an evidence of patriotism rarely seen elsewhere, and which bodes ill for the enemies of such a people.

The greatest factor in this example of discipline was the absence of intoxicating liquors among both officers and men, and we could but contrast it with the stories of other battles in the east between Mohammedan and Christian troops, where a barrel of whiskey was regarded by the former as an equivalent to a reinforcement of one hundred men, for by rolling the barrel of whiskey before an advance guard of the enemy it was sure to be greedily attacked, to the advantage of the abstemious Turk.

This counter revolution in Turkey, which Shefket Pasha did everything in his power to make as "bloodless" as was the revolution of 1908, was so quickly and completely suppressed that constitutional government was placed upon a higher and firmer basis than before, and on the day the *London Times* (to which I have referred) was read in Constantinople, Abdul Hamid was the nation's prisoner, never again to use his weapons of bloody intrigue. His impeachment was done in strict accordance with the constitution and the religious law of the land, and his shameful reign came to a final ending by the selection of his illustrious successor, Mohammed V, who had

SHOE STORES IN THE ORIENT



SCENE IN A TURKISH BAZAAR

ROBERT COLLEGE, FOUNDED BY AMERICANS, AND THE CASTLE AT ROUMELI HISSAR, ON THE BOSPORUS

"Americans little realize what an important influence their countrymen and countrywomen have exerted in bringing about constitutional government in Turkey. . . . 'For 80 years the American missionaries have been laying the foundations and preaching the doctrine which makes free government possible' . . . The great educational system founded by these Americans comprises at present more than 300 common schools in the Empire, 44 high schools, 8 colleges, 1 normal school, and 5 divinity schools."

THE FAVORITE AND SUMPTUOUS PALACE OF MANY SULTANS: DOLMA BAGHTCHEH, ON THE BOSPORUS

A TWO-OARED CAIQUE ON THE BOSPORUS: THIS PICTURESQUE CONVEYANCE HAS BEEN ALMOST DISPLACED BY MORE MODERN, MORE SERVICEABLE, BUT LESS PICTURESQUE BOATS

been confined in a palace on the Bosporus for 33 years of his life, the period of his predecessor's reign, and who is now the beloved ruler of his people.

TROUBLES IN ALBANIA

No country in the world ever gained the priceless blessing of freedom without some trials. In October, 1910, the province of Albania, one of the western colonies of Turkey bordering on the Adriatic Sea, began to give trouble, and as a matter of course it was announced by European news-gatherers, who by the way give us all our information regarding Turkey, that this was due to the undying hatred of the followers of Islam for all Christians, and that it was for the purpose of exterminating them that this conflict was inaugurated by the Turk.

It should be remembered that during the last years of Abdul Hamid's reign the Albanians were his most trusted adherents in the army. In order to maintain their loyalty to his person he had released the colony from the payment of taxes and cajoled them into doing his bidding by many acts of favoritism not accorded to the troops recruited in other parts of the country. In this way he kept their fealty. But when the new order of things was established and liberty and equality became the watchwords of the nation, the Albanians accepted all that was coming to them of the first, but declined to give up any of their former privileges in the interests of equal rights They demanded that only the Albanian language should be used in the schools and that the dominant race—the Turks—who had acquired possession of the country by conquest—the strongest claim that any people can set up—should have nothing to do with the internal policy of their land.

Naturally the ruling powers of the Empire could not agree to any such conditions, and an Albanian revolt against constitutional authority followed. The Albanians are a hardy mountainous race of men, who have kept themselves poor and their land barren by internecine wars ever since they, as a part of the Mohammedan race, conquered the country.

It was declared by the numerous interested sympathizers with the revolutionists in Europe that the Turks could never conquer Albania. But in spite of this widely dispersed impression, Mohammed Shefket Pasha, who had now become Minister of War in the Cabinet, went with a portion of the army to the scene of the revolt, and in less than six weeks the Albanians were suing for peace by presenting him with the usual ceremonious bowl of milk as a token of submission.

Like General Grant, Shefket Pasha was called a "butcher" for the drastic and energetic measures used by him in putting down the rebellion, and a cry of "foul massacre of the Christians" went up from all over Europe. No attention was paid to the fact that the majority of the inhabitants of Albania are of Mohammedan persuasion, and that the conflict was due neither to religion nor race, but to politics.

Hardly had the Albanian revolution been put down before another broke out in the Yemen, the southeastern part of Turkey in Asia. The Bedouin tribes in the Arabian desert attacked the outlying military stations there, very much as our own Indian races have repeatedly done in the United States. This outbreak was of such proportions as to necessitate reinforcements from all parts of the Turkish Empire, and the European military posts were depleted of troops in consequence. The Albanians, still smarting under the condign punishment inflicted upon them during the late uprising, at once took advantage of this situation to again take up arms, such as they could command—and there were many willing sympathizers to bring them supplies—but this outbreak was so short-lived as to hardly warrant newspaper mention.

UNITED IN TRIPOLI

The outcome of the Yemen insurrection is best told in a statement made by Hilme Pasha, a former Grand Vizier of Turkey, as recently published in a letter from Constantinople. He says: "Turkey's ex-enemy in Yemen, the Imam Yahra, who concluded peace and friendship with the Sultan, is declared to have

A CEDAR OF LEBANON, IN SYRIA

The cedars of Lebanon have been famous from early times. The original groves mentioned in the Bible have become greatly reduced, and the largest grove now known contains only about 400 trees, some of which are evidently of great age. The trees are noted for the size of their trunks rather than for their height. They differ from most conifers in that their branches are wide-spreading. The cones and leaves resemble those of the larch more than any other tree, except that the leaves are persistent. It thrives in the United States only in the South and in California.

A HOLY MAN (MOHAMMEDAN), OF SYRIA

VIEW OF HOMS, ON THE DAMASCUS-ALEPPO RAILWAY: SYRIA

Homs has been an important town for thousands of years, as it connects the Great North Road from Egypt, Palestine, and Damascus by the Orontes Valley. The town or its vicinity has been the scene of savage battles from the time of Rameses. The Arabs made it one of the largest cities in Syria, with tremendous walls and a strong citadel. The ruins of the latter may be seen on the hill in the distance. The construction of the Damascus-Aleppo Railway is bringing back much of its former prosperity, as the surrounding district produces much silk,

BRINGING WHEAT TO THE RAILWAY AT HOMS

A GAME OF BACKGAMMON, IN SYRIA

spontaneously promised to render solid assistance to his Moslem comrades in Tripoli." Another newspaper dispatch refers to the "solid assistance" as an armed force of 10,000 men from this tribe contributed to the defense of Tripoli.

This would seem to prove the truth of what has frequently been stated by Turkish sympathizers: that it is only necessary for foreigners to strike a blow at the integrity of Turkey to bring about a coalition of Mussulmen in defense of the Empire.

During these internal trials of the new Turkish government, Greece again demanded that the promise made by England, that she should be put in possession of the beautiful island of Crete, should be fulfilled, and took advantage of Turkish misfortunes in Yemen to press her claim. But the Young Turk party promptly informed the British authorities that not another inch of territory would be given up to any power. They announced that Turkey would fight to the death to maintain her sovereignty in Crete, and that England herself would surely be brought into the conflict with disastrous results to the peace of Europe if this claim was pushed. With such an alternative staring her in the face, England was forced to disavow her promise to Greece, and the Ottoman flag still floats over Crete.

It is too soon to predict the outcome of the present conflict in Tripoli, but if it results in a "holy war," as is not unlikely, it would seem that there can be but one result in the issue. Emperor William II, a few years ago, made a speech in Jerusalem, in which he said, in effect: "Allied as I am with my good friend Abdul Hamid, the Padishah of 225,000,000 Mohammedan subjects, Turkey, in combination with my grand army, need have no fear if the whole world combines against us."

Emperor William, by this appeal for Moslem support, was but inviting in advance the very danger to western civilization that now threatens.

But what nation is there that does not appeal to the divine power that rules its destiny when the stress of war comes? "God favor our righteous cause," is the cry on the lips of every believer, whether he be Moslem, Jew, or Gentile; or, to quote from an inscription found upon the walls of the imprisoned British troops at Delhi during the Indian insurrection:

> "When war is rife and strife is nigh,
> God and the soldier is all the cry;
> When war is o'er and peace requited,
> God and the soldier is always slighted."

CORRUPTION IS AT AN END

I have thus attempted to give a brief account of Turkish history during the past three and one-half years, which is a record of stupendous trials that have beset the Young Turk party in their efforts to help the country in its way toward reforms and a new national life.

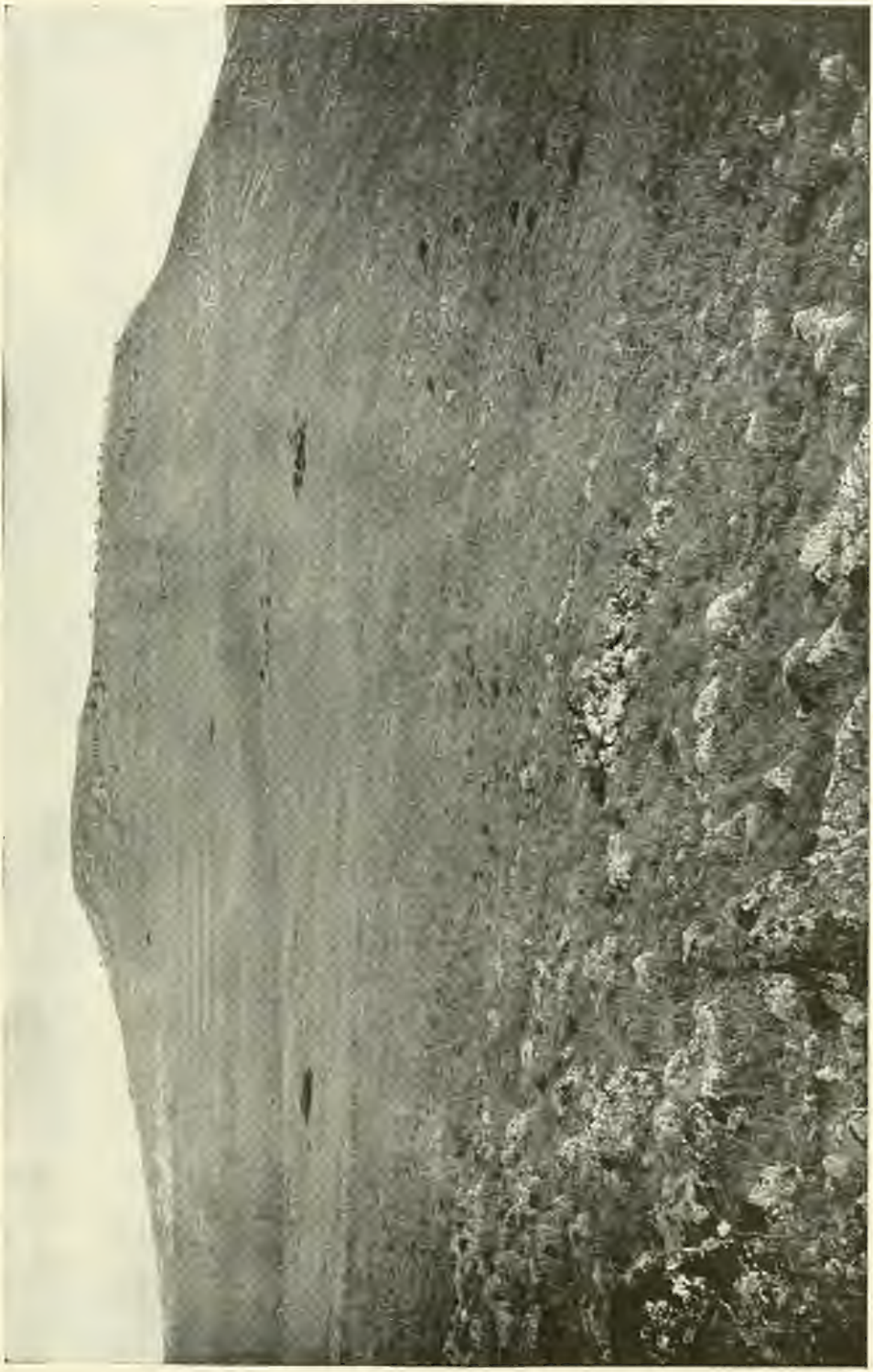
The question is: Have the Young Turks fulfilled, as far as might be expected under the prevailing difficulties, promises made when they took office? The answer may be summarized as follows:

It is only necessary to note the happy, smiling faces of the inhabitants in Turkey today to realize that despotism is a thing of the past. Order in the Empire has been kept under the most trying circumstances. Fraternization of the different races, which at first might have been interpreted as the exuberance of the freedom of action permitted by the constitution, has continued. Fear has been banished, ambition for knowledge strengthened, and thought enlivened. Corruption, which, under the old régime, was rampant, is now speedily brought to justice, so that today there is no more honest administration of governmental affairs in the world than in Turkey. The strength of the foreign policy of the government is demonstrated by the stand it took against England in the case of the island of Crete, while the stability of the internal program of the Young Turks is shown in the frequent successful rapid-transit movements against revolutionists.

If we would but "look for the good that is in the worst of us instead of the bad that is in the best of us," we would find some characteristics of the Turkish race that we might emulate to advantage. I do not except from these many of their

FISHERMEN ON THE SEA OF GALILEE, NOW CALLED THE LAKE OF TIBERIAS: PART OF THE TOWN OF TIBERIAS MAY BE SEEN IN THE DISTANCE

Tiberias was built by Herod between 16 and 22 A. D., and was named in honor of the Emperor Tiberius. As Herod had to disturb an ancient graveyard to make room for the city, the Jews refused to live in it, but after the fall of Jerusalem it became the chief center of Rabbinic learning, the Jerusalem Talmud being edited here. The town today has a population of less than 4,000, and is notorious for its dirt and fleas.



THE HILL FROM WHICH JESUS CHRIST IS BELIEVED TO HAVE PREACHED THE SERMON ON THE MOUNT

IN THE SYRIAN DESERT, EAST OF THE LEBANON

religious forms. The total abstinence from intoxicating liquors among the Moslems is due to a strict tenet of their religious creed.

The Mohammedans worship the same God as do the Christians, with a devotion that is inspiring to any one devoutly inclined; and even in their reverence of the great Head of the Christian church they set an example worthy of emulation. If one would visit the Church of the Holy Sepulchre at Jerusalem and see the devotional attitude of the Moslem guard the government of Turkey is forced to maintain there to keep the peace—not between the Mohammedan and Christian, but between the Christian sects themselves, who there worship at the shrine of our Saviour—he will be forced to blush for his own religion while he pays a tribute of respect to Islamism.

That detestable subject of polygamy among Mohammedans of today is not fully understood by us. While plurality of wives is permitted by the Koran, its practice is unquestionably dying out in Turkey.

THE LEADING WOMAN OF TURKEY

One of the finest women I have ever met, who is of the Mohammedan faith, is now engaged in Constantinople in a propaganda for the education of the women of Turkey, which is full of promise for the social status of the mothers of the country.

To this grand woman I cannot refrain from paying a tribute of greatest respect. Helideh Salih, a graduate of the American College for Girls, is the leading woman in Turkey in popularity and influence. She is at the head of this organization for the redemption and uplift of her countrywomen. Already has the government, at her instigation, officially installed five Young Turkish women at this magnificent American school of learning, in cöoperation with her work.

I am sure that American women could not read the pathetic cry of this Turkish woman to more civilized womanhood for their support and sympathy without a heart pang that would shake their very souls. I wish I might give it in full.

"Come," she says, "to this land where the most terrible want of knowledge exists. Come and help us to disperse the dark clouds of ignorance." That grand American woman, Miss Helen Gould, has already answered her appeal with munificent aid through the American College for Girls, which now has hundreds of young women students of pure Turkish blood, where during the Hamidian reign it had but one.

I have stated that Turkey is as far advanced in popular government today as were the American people at the end of the first decade of its constitutional history. This is no idle statement, and, as a matter for comparison, I would like to recall a brief outline of the events occurring in our own country during this period:

In the heyday of our prosperity, we are apt to forget the mistakes made by our forefathers in their efforts to establish popular government, only remembering the grand things accruing from their endeavors, after a long experience in handling the Ship of State.

Three years after the Treaty of Peace established between the revolting American colonies and the Mother Country, 1783 (the same period of time that has elapsed since the constitution was proclaimed in Turkey), we find, according to history, that the citizens of the various States in the American Union discovered, *by experience,* the disabilities to which they were subject from a want of proper system, and began to clamor for reform.

Commissioners, called together at a weak-hearted convention in Annapolis, announced that "the crisis is arrived, at which the people of America are to decide the solemn questions, whether they will reap the fruits of independence and of union, or whether, giving away to unmanly jealousies and prejudices, or to partial and transitory interests, they will renounce the blessings prepared for them by the Revolution."

During seven or eight years, in fact, after the War for Independence ceased, the nation was humiliated to the quick

GENERAL VIEW OF THE ACROPOLIS AND THE GREAT TEMPLE RUINS AT BAALBEK

Baalbek was once the most magnificent of Syrian cities, full of palaces, fountains, and beautiful monuments. Today it is famous only for the splendor of its ruins. The glorious temples at Baalbek were built by the Romans early in the Christian era, being dedicated by Septimus Severus about 200 A. D. Immense treasures were lavished by the Roman emperors upon these wonderful buildings. Baalbek is situated on a branch of the Damascus Railway (see the map which is published as a supplement).

THE BIGGEST PIECE OF STONE EVER BLOCKED OUT IN A QUARRY

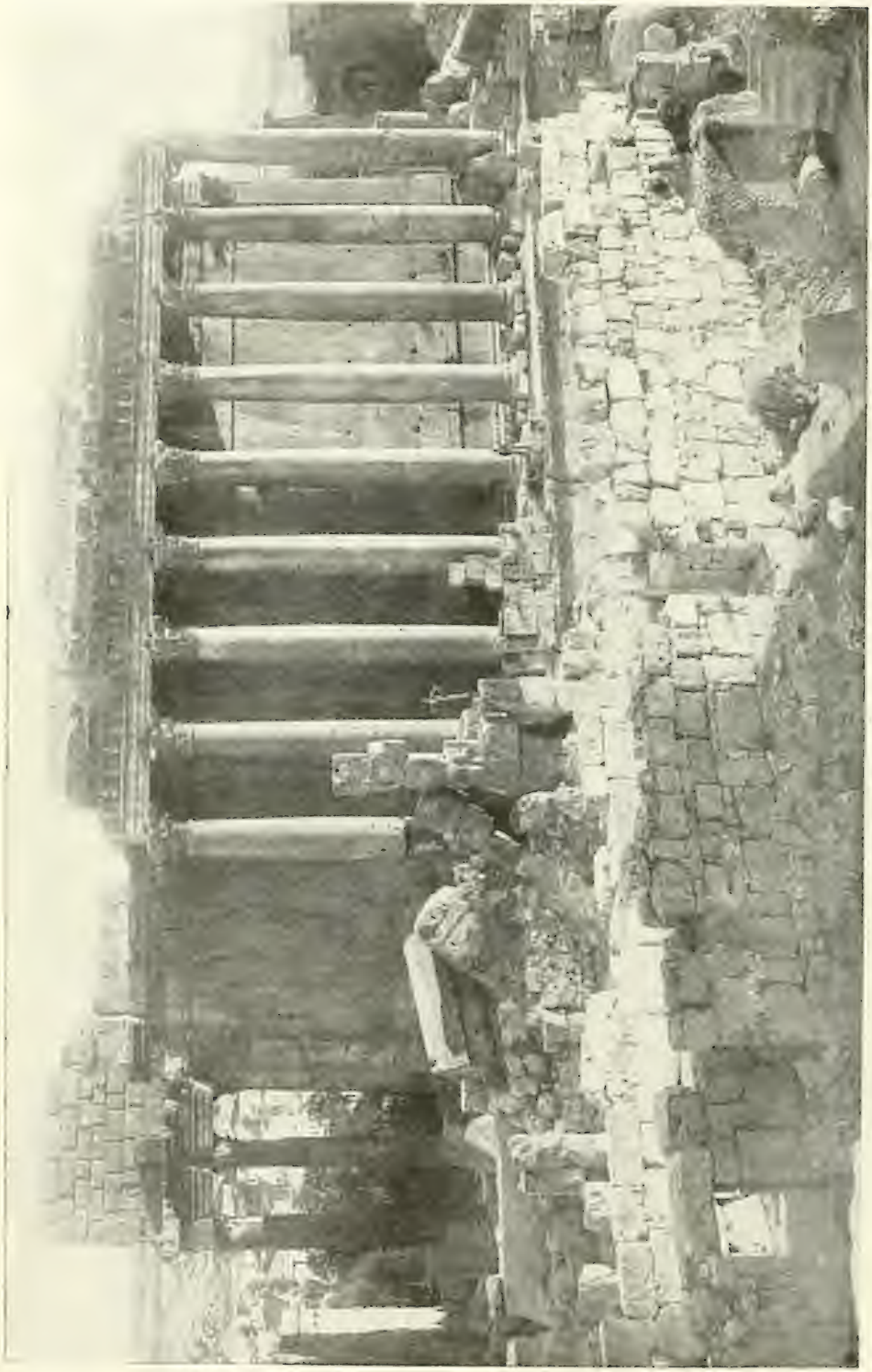
It is 68 feet long by 14 feet high and weighs about 1,500 tons. The block is still attached to its bed in the quarries, about one-half a mile from the ruins of Baalbek. The Temple of Jupiter contains three megaliths almost as large as this gigantic block

SCENE AMID THE RUINS AT BAALBEK: NOTE THE MAN

The history of Baalbek before the Roman era is involved in darkness, but it is certain that from very distant times it was one of the principal seats of sun worship

THE GREAT TEMPLE OF JUPITER, OR OF THE SUN: BAALBEK

This was the largest and most famous of the temples. It was sacred to Jupiter (Baal), with whom were associated Venus and Mercury. This magnificent building formerly boasted 54 columns, of which these 6 remain. The pillars are formed of three blocks and are 60 feet high. Note the man standing beside the pillar.



THE TEMPLE OF BACCHUS, BAALBEK: THIS TEMPLE IS SMALLER THAN THE TEMPLE OF JUPITER AND IS BETTER PRESERVED

GREAT GATE TO THE TEMPLE OF JUPITER: BAALBEK

Legend states that the Temple of Jupiter contained a golden statue of Apollo, or of Zeus, which at annual festivals was borne on the shoulders of the chief citizens through the streets of the town, which was then called Heliopolis.

THE INTERIOR OF THE TEMPLE OF JUPITER: BAALBEK

When Constantine was converted to Christianity the temple became a Christian church. The Arabs sacked all the buildings in 748, and converted the Acropolis into a fortress and constructed large battlements around it. Succeeding wars of Arabs, Tartars, Turks, and Crusaders, and earthquakes gradually reduced the buildings to their present state. Many of the magnificent pillars were overturned merely for the sake of the iron which bound the blocks together.

by the defeat of our armies in conflict with Indian tribes, similar, in some respects, to the races that have made trouble for the Turks; and as late as 1798 a strong party—the Federalists—under the leadership of Alexander Hamilton, were contemplating an alliance with England, and the cry "Let us have a king!" was quite as frequently heard as "Support the President!" and such reaction against constitutional government finally led to the perfidy of Aaron Burr.

America, as a Christian nation, now well advanced in years, bearing a history replete with unselfish action towards weaker nations, can well afford to continue the practice of the Golden Rule in its attitude with respect to these people of the "Near East," who are the pioneers, among Mohammedan races, in the struggle for government "of the people, for the people, by the people;" and, if upheld by Christian sympathy, will surely spread the doctrine of freedom which came down to us as a birthright from our forefathers, who purchased it for us at a fearful cost of blood and treasure.

This spirit, set up here in Turkey, has been carried like a tidal wave through Persia, the States of Central Asia, right into the very heart of the great Empire of China, where is begun an irrepressible conflict for liberty, toward which the whole world is marching.

To America, the first-born child of political and religious liberty, this Eastern civilization turns in its hour of trial for the sympathy and encouragement which we so naturally should give, as the one power that can help them in their battle against despotism and oppression. Persia is now struggling in the throes of political reform, and is knocking at our door for a kind word to aid her in her efforts to secure freedom.

Shall we not, then, in the name of Him who died to make men free, extend to the regenerated people the hand of fellowship, as we watch, with sympathy and hope, their struggles for this divine right bequeathed mankind?

THE GREEK BRONZES OF TUNISIA

By Frank Edward Johnson

With Photographs by Courtesy of Monsieur A. Merlin, Directeur des Antiquities et Arts of Tunisia, North Africa

THE picturesque little Arab town of Mahdia (Mahadia) lies between Soŭsse (Susa) and Sfax (Sfaks), on the coast of Tunis. The honk-honk of a tourist automobile seldom breaks the silence of this small town, and the coast steamers usually pass during the night, so that the beautiful skyline of the minarets and flat-roofed Moorish houses outlined against a sunset sky are rarely seen by European eyes. Roman ruins dot the foreground, running almost into the sea, and on top of the hill are the remains of an old Spanish fortress that reminds one of the Spanish Invasion.

In June, 1907, Greek sponge-divers were busy bringing up sponges out of a sapphire-colored sea, streaked here and there with emerald green, when one of the divers came up greatly excited, saying that he had seen what looked like cannon lying in the sand. He was laughed at by the members of the crew; but the captain of the ship went down to investigate, and found the remains of a Greek galley filled with building materials and bronzes and marbles for the erection of a villa at Rome. The discovery was immediately reported to Monsieur A. Merlin, Director of Antiquities and Fine Arts in Tunisia, a man of great knowledge and experience, whom the French government had sent out to take charge

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THE LITTLE DIVERS' BOAT, USED IN RECOVERING THE BRONZES (SEE PAGE 101)

For location of Mahdia, see map published as a supplement to this number

of the museums and the excavations of the Protectorate of Tunisia in northern Africa.

Monsieur Merlin went immediately to Mahdia to investigate for himself, and found that the Greek galley carried on its deck 40 or 50 huge marble columns, the weight of which prevented the divers from getting at the lower decks.

Unfortunately, funds for excavating purposes were at a very low ebb at this time, and the French government very unwisely did not coöperate in its various departments; so that, in spite of the fact that there were in the marvelous naval harbor of Bizerta, near Tunis, lying idly at anchor, huge French dreadnaughts and men-o'-war, with crews numbering from 800 to 1200, and carrying complete diving equipments not being used, nothing was done by them to advance this work, when at a word from the Minister of Marine any of these vessels could have been sent down to Mahdia and, at no extra cost or expense to the French government, have placed a large equipment of divers at the disposal of the Director of Antiquities and Fine Arts, thus accomplishing the work of bringing to the surface all these wonderful treasures.

On the contrary, Monsieur Merlin had to hire local Greek divers from the port of Mahdia, and these curious marine excavations have been carried on with but a few thousand francs a year.

The sunken galley lies about five kilometers off the coast, in rather deep water. The exact spot is hard to mark, because the sea runs in very heavily, and there are numerous currents that frequently carry away the large buoys that are anchored there to mark the spot.

Sallust, the Roman writer, has already described the Mediterranean on this part of the coast of Africa as being "terrible," and it has not changed since he wrote about it.

The Greek bronzes and marbles which have been recovered from the galley during the past four years are of most interest to us. The bronzes are of two cate-

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NO. 1. EROS: ATTRIBUTED TO PRAXITELES

The bronze is almost life-size, and stands 1 meter 40 centimeters high. This god has just alighted from flight. His wings seem to beat the air. His right arm points to a crown of laurels, and in his left hand he held a bow, which was never found. Eros has just won the laurel wreath at archery.

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NO. 2. STATUETTE OF A SATYR ABOUT TO RUN: HEIGHT, 35 CENTIMETERS

The expression and action in this bronze are remarkable, as well as the scowl on the brow, the slightly opened lips, and the dilated nostrils. One cannot help thinking of the "Dying Gaul" in the Museum of the Capitol at Rome. Pliny informs us that the Gauls wore long hair, which made them resemble Pan or Satyrs.

gories—bronzes for decorative purposes and statutes. When they were taken out of the water they were covered with thick deposits of seashells and mud. Curiously enough, the bronzes withstood their 2,000 years' sea-bath better than the marbles.

In this short article we shall speak especially of the eight following bronzes:

No. 1 is the god Eros, attributed to Praxiteles. He stands one meter 40 centimeters high, almost life-size. This god has just alighted from flying; his wings seem to fan the air. In his left hand he holds a bow (which is now missing). His right hand is lifted to his head and points to a crown of laurels, which has evidently just been won at archery. This statue when found had its legs badly battered in. The wings were missing, and only last year was his right arm found. Because of the size of this bronze, it is one of the most important works of Greek art. To whom must it be attributed? It is incontestably an original and is probably by Praxiteles, because a Greek authority named Calustige left behind the description of a bronze statue of the god Eros by Praxiteles which resembles in a most marvelous way this bronze. The following is a translation of Calustige's description:

"It is an Eros, a work of art by Praxiteles—Eros himself, in the adolescent flower of his youth, with wings, carrying a bow, affixed to a base from which he cannot move. He gives us the illusion that he is going to fly away. He bends back his right arm toward the top of his head, and in his left hand he holds a bow. The weight of his body is carried on his left leg." Whoever this unknown sculptor was, the bronze not being signed, it is certain that we have an Eros here worthy of the famous sculptor.

No. 2 is the statue of a satyr, starting to run. It stands 35 centimeters high. The movement is marvelous. The power and grace of his figure, crouched ready to spring, his arms outspread like a runner starting in a race, the frown on his face, his dilated nostrils, and his slightly opened mouth—all make him seem almost alive. The movements of his most realistic attitude are remarkable, resembling the school of Pergam towards the end of the third century B. C. This statue reminds one of the Gauls, especially the monument of Attele I and the Dying Gaul in the museum of the Capitol at Rome, for "Diodore of Sicily" writes that the Gauls had hair which made them resemble a Pan, or satyr.

No. 3 shows the cakewalk of the Grecians 2,000 years ago. This little statuette, 30 centimeters high, proves that the hobble skirt was not the creation of Paris dressmakers in 1911, but of some great modiste of Athens. These statuettes are extremely rare in Greek art, as they represent dwarfs with abnormally large heads and grotesque figures. Greek sculptors admired form in line so much that one rarely found ugly or comical works of art among them. The Romans at the time these figures were made enjoyed watching the antics of dwarfs, male and female, and grotesque jesters during their banquets, and these three statuettes (pages 94, 95 and 97) were doubtless lifelike copies of some well-known public entertainers.

No. 4 is a pendant to the cakewalk dancer, 32 centimeters high. Her eyes are of ivory. She is swinging her foot behind her, whereas the foot of the dancing figure is in front, with her head turned to the left. The former figure has her head turned to the right, and is crowned with a laurel wreath.

No. 5 is a buffoon, or jester—height, 32 centimeters—which completes the series of three statuettes. He is repulsively ugly. He walks forward à la cakewalk, with a twisted body and grimacing face. He had only one eye ,the left, and the round ball which forms his eye is in silver. This brilliant polished metal forms a curious contrast to the greenish bronze of his body, and gives him a devilish look.

No. 6 is a small Eros, 42 centimeters high, advancing toward one, dancing and singing to the accompaniment of his lyre. He has a number of bracelets on his wrists and on his left thigh. His charming grace and elegance make one think of certain terra-cottas; for example, those of Myrima.

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NO. 3. STATUETTE SHOWING THE CAKEWALK OF THE GRECIANS 2,000 YEARS AGO AND THE HOBBLE-SKIRT OF ANCIENT ATHENS, REVIVED BY THE PARISIAN DRESSMAKERS IN 1911

"These statuettes are extremely rare in Greek art, as they represent dwarfs with abnormally large heads and grotesque figures. Greek sculptors admired form in line so much that one rarely found ugly or comical works of art among them."

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NO. 4. PENDANT TO THE CAKEWALK DANCER: HEIGHT OF THIS STATUETTE, 32 CENTIMETERS

Her head is crowned with a wreath. Her eyes are made of ivory, which adds to the realistic effect. "The Romans at the time these figures were made enjoyed watching the antics of dwarfs, male and female, and grotesque jesters during their banquets, and these three statuettes were doubtless life-like copies of some well-known public entertainers."

No. 7 is a Hermes of Dionysos. The face has a classical nobility, and the beard and hair remind one of early Babylonian sculptures seen in the Louvre or the British Museum. On gazing at this statue the question arises: Is this a Greek work of art? Rather an antiquity handed down from Babylonia; but the treatment of the beard and the hair, which latter is arranged in three rows and the curls falling in spirals down the back, are too detailed and conventionalized to be of an older date. The artist has evidently in a moment of caprice given this head a Babylonian resemblance. Fortunately we are able to state the exact date of the Hermes, for on his right arm we find an inscription in Greek in very small characters:

Βόηθος Καλχηδόνιος 'εποίευ ("Boéthos the Chalcedonian made it").

Boéthos lived toward the end of the third century and the first part of the second century B. C. Fortunately we know who he is. Pliny quotes him among the most noted designers of Greek coins, and he is also well known as having made the statue of "A Child Strangling a Goose," of which several museums possess replicas, one being in the Louvre. This artist, during the lifetime of Antioch IV, King of Syria, between the years 175 to 164 B. C., executed at Delos a statue of this prince. The Hermes of Mahdia dates, therefore, during the first half of the second century B. C.

No. 8 is a horse's head in bronze. The treatment of its mane is remarkably lifelike.

No. 9 is the head and bust of Aphrodite in marble. The breast and hair have been much damaged by the water, but fortunately the face and profile have been spared. It has most noble and beautiful features. It is doubtless a copy of an original of the fourth century B. C. It is only a fragment of a heroic statue, which was made in several pieces. Probably the other pieces of the statue arrived in course of time at Rome.

WHITHER WAS THE GALLEY GOING?

The question naturally arises: Where were these Grecian galleys going, and where had they come from? Fortunately manuscripts have been preserved that tell the story of how a galley, ladened with art treasures, was sent to Rome from Greece by Sylla after he had conquered Athens. Sylla had already sent great numbers of marble columns to be used in rebuilding the Capitol at Rome, which was burned during the civil war in the year 83 B. C.

Lucien describes a Greek vessel filled with art treasures that was sent to Rome by Sylla after he had conquered Athens, and this vessel sank in the neighborhood of Cape Malia, near a place called Laconie (extreme southeast cape of Greece). Is not this example particularly significant and curious when compared to the Mahdia galley? But the following is also of interest:

Atticus, a great friend of Cicero, was at Athens in the years 67 to 66 B. C.; that is to say, at about the date the Greek galley was supposed to have sunk. Cicero wrote him a number of letters, which, fortunately, have been preserved, and in them we read the following:

"I am most delighted to learn that thou hast bought me a Hermes in marble, with the head of an antique (Arian), and other art treasures. Send them to me as soon as possible, for I would have them immediately." And again: "I have received the statues in marble from Megare that thou hast sent me. They have given me the greatest pleasure. I shall have them transported to my villa at Tusculum. If thou findest any statues that thou thinkest would please me, do not hesitate to buy them for me."

Several years later he wished to procure some marble columns for a tomb that he intended erecting to his daughter, Tullia D'Athenes.

For many years past, shipments of statues, columns, and precious ornaments had been sent from Greece to Italy for use in the erection of public monuments or private dwellings, or for the ornamentation of private pleasure villas or great Roman palaces, or for the beautifying of Roman gardens or the huge Triclinium, or banqueting halls.

In the galley of Mahdia huge marble columns were found that would have supported a superb edifice; bronze and

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NO. 5. STATUETTE OF A MALE DWARF DANCING THE CAKEWALK: HEIGHT, 32 CENTIMETERS

His repulsive ugliness is increased by his being given but one eye, which is made of polished silver. He advances, twisting and contorting his body and making faces. All three statuettes seem to be dancing to the sounds of a sort of castanet that they hold in their hands.

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NO. 6. A STATUETTE OF EROS PLAYING ON HIS LYRE: HEIGHT, 42 CENTIMETERS

Notice the ornamental bracelets around his ankles, arms, and thigh. His graceful form reminds one of certain well-known terra-cottas by Myrima

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NO. 7. HERMES OF DIONYSOS, BY BOÉTHOS THE CHALCEDONIAN

Who lived toward the end of the third century B. C., and is known to all numismatists as a celebrated designer of Greek coins (see page 96)

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NO. 8. BRONZE HEAD OF A HORSE, USED FOR DECORATION

marble statues to beautify the interior; bronze candelabra that would have harmoniously lighted the great entrance; statuettes that would give joy to the eye of the beholder, or smiles and laughter by their grotesque appearance; furniture that would give ease and comfort to the luxurious Romans; inscriptions that would be the pride of a man of letters for his library.

Are we not right, therefore, in supposing that the sunken Greek galley of Mahdia was one of those engaged in transferring the trophies of war, conquered by the Romans at Athens in the year 86 B. C., and that the entire cargo was composed of the spoils which Sylla was taking back with him, just as Mummius had taken years before, when he took for himself, his friends, and for the temples at Rome the spoils of Corinth?

Those old Romans who counted on the safe arrival of this Greek galley with their art treasures did not take into consideration "Poseidon," the Greek god of the sea, or "Boreas," the Greek god of the north winds.

The treacherous Mediterranean claimed this galley for its own. Driven out of its course by wind and sea, too heavily laden to be seaworthy, the galley was hard to steer. Heavy seas washing over her opened up a seam, and down she sank, with her priceless art treasures, to be found almost 2,000 years later. Who knows but that it was the anger of the gods of Greece for having had their temples desecrated by the Romans that caused the Greek galley to sink, thus saving for generations yet unthought of the wonderful Greek works of art that today grace the Museum of the Bardo, about three kilometers outside the walls of Tunis?

Great changes have taken place in Tunis during the past 25 years. As a boy I remember the Palace of the Bardo as the residence of the Bey of Tunis. Now about half the palace, formerly the harem, has been turned into a remarkable museum for Phœnician, Roman, and Greek antiquities found at the countless Roman, Byzantine, and Phœnician ruins dotted all over the country. The exquisite collection of mosaics surpasses any other museum, and is, alas, not well known. Even the Louvre and the British Museum cannot be compared to the Museum of the Bardo for its Roman and Phœnician collections.

Curiously enough, the land of Dido is coming to its own once more. A great empire is springing up in northern Africa. France, of all countries in the world, ranks first in her admiration for art and all things beautiful. It is therefore doubly fitting that within a few miles of the site of ancient Carthage is to be found under the French flag this marvelous museum.

It is impossible to adequately describe the great difficulties in raising these bronzes and marbles from the sunken galley. The little *sakolève,* or divers' boat, in which the divers work, was hardly larger than a Gloucester seine-boat, and the columns were exceedingly heavy. The divers had to work at a depth of 39 meters, or about 120 feet. The objects, when brought to the surface, had to be cleaned, for they were covered with a thick coat of mud, dirt, and seashells. It was impossible to tell whether an object was a bronze statue of human shape or a broken bit of a marble column. The missing parts had to be found and put together, and the greatest credit is due to Monsieur A. Merlin for his tireless energy and perseverance in spite of every sort of obstacle, not the least of which was the absence of funds with which to continue the work.

The French government is to be complimented on having a man like Monsieur Merlin as Director of Antiquities and Fine Arts in Tunisia. He is one of the great authorities on Roman and Greek inscriptions and has already done notable work in France.

The thanks of the author are due to Monsieur Merlin for his kindness and courtesy in giving him the photographs published with this article, and for much valuable information. Many of the above statements are quoted from his work, "Les Fouilles Sous-Marines de Mahdia."

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NO. 9. A HEROIC MARBLE BUST OF APHRODITE

The hair and breast have been badly damaged by boring sponges during its 2,000 years' submersion in the Mediterranean. The profile is of great beauty, especially the right profile, of which, unfortunately, no photograph exists (see page 96).

Photo from E. Dana Durand

COSTUMES IN CRETE 3,500 YEARS AGO (SEE PAGES 13 TO 16)

This picture shows the painted side of a wooden chest found in Crete. It represents a funeral procession. The figure at the right is the corpse. Note the double axes on standards at the left

THE GREEK BRONZES

SO MANY requests are being received from members desiring original photographs of the wonderful Greek bronzes illustrated in this number that a special arrangement has been made with the Museum of Antiquities of Tunis to supply a very limited number of photographs on special paper; size, 9 by 12 inches. The price for the complete set of nine photographs, mounted, is $20; for single pictures, $3. Orders should be sent to the National Geographic Society. The proceeds will be forwarded to the Museum at Tunis to further its work of exploration.

MAP OF MEDITERRANEAN REGIONS

THE readers of this Magazine will find the map published as a supplement to this number exceedingly useful during the coming months, owing to the growing interest in Morocco, Tunis, and Tripoli, and in all sections of the Mediterranean Sea. Many articles will be published in the Magazine during the present year on this region, so that the map will be a convenient form of reference to these articles. Members desiring extra copies can obtain them by addressing the National Geographic Society and enclosing 50 cents for each extra copy desired.

Early numbers of the NATIONAL GEOGRAPHIC MAGAZINE will contain a splendid map of China in colors, 16 by 22 inches; a bird's-eye view of the Panama Canal in colors, 9 by 18 inches, and several beautiful panoramas.

NATIONAL GEOGRAPHIC SOCIETY

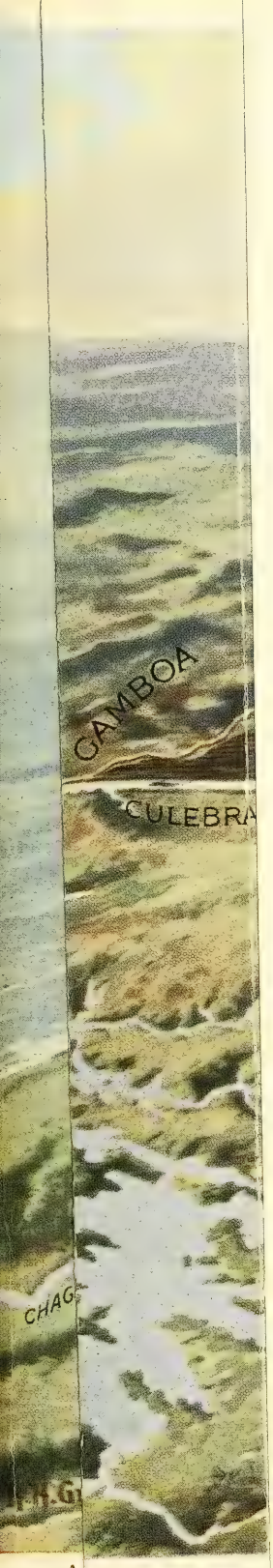
THE National Geographic Society has been advised by the trustees of the late Miss Jane M. Smith, who recently died in Pittsburgh, that the Society has been bequeathed the sum of $5,000 by Miss Smith. It was directed by Miss Smith that the said sum be invested and the net income thereof be used for the purpose of creating life members of the organization in cases where worthy and competent persons are not able to pay for such memberships. She left a very large estate, of which more than $100,000 is bequeathed to 15 educational and religious institutions. Miss Smith was a life member of the National Geographic Society, and was always interested in scientific work. During her lifetime, with her sister, she gave the University of Pittsburgh a splendid collection of minerals, known as the Smith collection.

Mrs. William E. Curtis has given to the National Geographic Society the rich collection of lantern slides made by her late husband, the well-known author and traveler, William Eleroy Curtis. Mr. Curtis had been a member of the Society from its organization. He had always shown a keen appreciation of the National Geographic Society, and in many ways had contributed to its work and welfare.

The American Government. By Frederick J. Haskin. 395 pages. With illustrations. J. B. Lippincott Co., Philadelphia. $1.00.

This book gives a delightful description of the many branches of the Federal Government. Its chapter on the work of the President has been approved by President Taft, and the descriptions of the other departments have each been read and approved by the head of the department, so that the reader may be absolutely sure that every fact contained in the book is correct. Members of the National Geographic Society will be especially interested in reading those chapters which describe what the American Government is doing in practical science for the health and wealth of the American people. The scientific bureaus of the government form the greatest academy of science man has ever known. The many branches of their activities are very graphically described by Mr. Haskin, and with a breadth of understanding that enables every one to appreciate the real value of this work, to which hundreds of the world's brainiest men are proud to give their lives and talents. Mr. Haskin has done a great service in writing and publishing "The American Government." A work of this kind has long been needed by the people, and they are to be congratulated that a man of his experience and understanding has written it.

"The American Government" should be in the library of every American citizen, that he may have a comprehensive knowledge of the stupendous work that is being done for him, and should also be used as a text book in every school, where it will stimulate a patriotic pride and deep interest in the heart and mind of the coming generation.



A

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Editor

BIRD'S-EYE VIEW OF THE PANAMA CANAL

THE NATIONAL GEOGRAPHIC MAGAZINE

ADAM'S SECOND EDEN

BY ELIZA RUHAMAH SCIDMORE

AUTHOR OF "JAVA—THE GARDEN OF THE EAST," "CHINA—THE LONG-LIVED EMPIRE," "WINTER INDIA," "JINRIKISHA DAYS IN JAPAN," ETC.

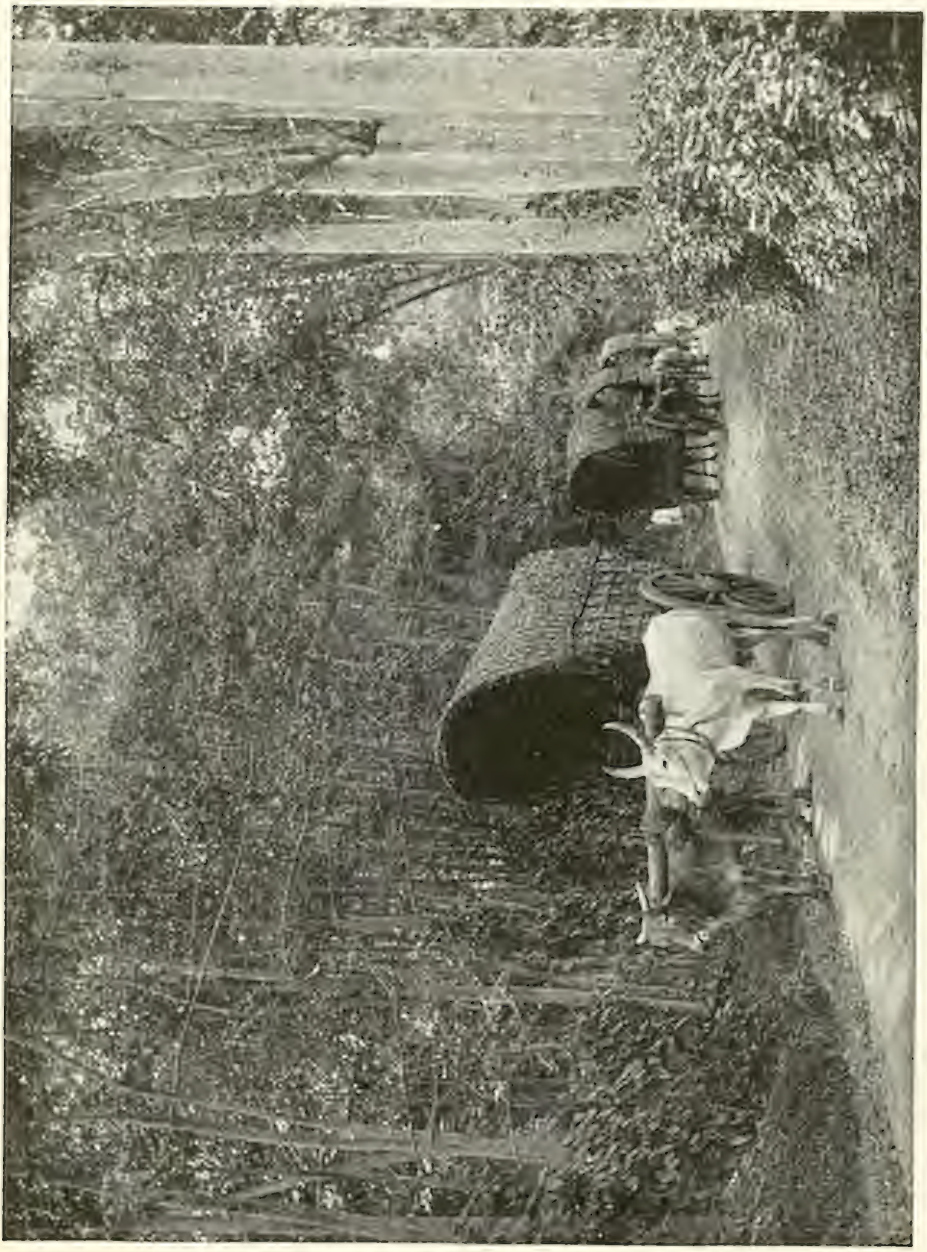
CEYLON, the second Paradise, to which Adam fled after the expulsion, is literally one of the "summer isles of Eden lying in dark purple spheres of sea." Its softly blue mountains rise up out of the sea and belt themselves round with a broad band of level, green lowlands, where crooked cocoa palms, with trunks aslant at every angle, reel on swollen feet to the very beaches of yellow sand and bend their tufted heads to the voice of the sea, without which, it is said, they cannot live.

One always comes into Colombo harbor at daybreak, from whichever quarter the ship sails, and the dawn's freshness adds to the beauty of the setting and the clearness of every impression. Native catamarans, rude dugout canoes, each with an outrigger log which keeps it level or afloat in any sea or surf, pursue each mail steamer into the protected harbor, and brown boys with their innumerable black and yellow brothers are ready to dive for coins until their cheeks bulge with the accumulated small change of all nations.

Then Arab boys climb straight up the iron side of the ship with Europe's and Colombo's latest newspapers, and a steam-launch puts one beside the model landing-stage, where England's might in the person of a pink-faced British constable maintains law and order in the crowds of chattering natives of every hue, clad in cottons of every strong color that can dare the tropic sun.

A hard red roadway stretches away in far perspective, lined with white buildings, and the tableaux and motion pictures begin. Big thatched carts drawn by splendid white bullocks and little carts drawn by tiny white bullocks, that trot like ponies, transport the brown folk and their families off to their quarter of the town, and, if the deep verandas of the "G. O. H." (Grand Oriental Hotel) beside the jetty do not engulf one on the spot, the most modern jinrikishas, with fat pneumatic tires, waft one across the neck of land to the other great hotel and center of interest at the edge of the sea. The *pad-pad-pad* of the runner's bare feet on the hard red roads are the only sounds, and there is no more motion felt than in a floating balloon.

The jinrikisha speeds past the clock tower and the old fort and the new barracks over to the great greensward of Galle Face, where the blue, blue sea stretches away unbroken clear to the Antarctic Continent, and the long, lazy surf of the Indian Ocean rolls in soft,



BULLOCK CARTS ON A COUNTRY ROAD: CEYLON

"Big thatched carts drawn by splendid white bullocks and little carts drawn by tiny white bullocks, that trot like ponies, transport the brown folk and their families off to their quarter of the town."

creamy white lines over the bright yellow sands—up to the bright red road and the intense green grass.

Every ship stops for a day at Colombo for coal and water, mails, and fresh stores; and all the earth—from East and West, from the Indian mainland and from the antipodes—meet at these two great hotels for midday curry and afternoon tea. All British folk know these two inns by their initial letters only, and in hot countries no Briton exerts himself to their full syllables, using a shorthand language for all such proper names and titles throughout "the gorgeous East."

Deep, dark-eyed Sinhalese boys beseech one to buy picture post-cards, old postage stamps, and match-box labels; and bearded Sinhalese in tight petticoats and white jackets, a child's round comb set backwards on their heads, like a reversed coronet, offer pillow-laces and "chicken-work" muslins, and pass trade messages to dark-eyed women in décolleté white waists, with strings and strings of bead necklaces on their plump brown necks.

The Moorman, the Jew, the Arabo-Armenian, the Malay, the Hindu, and the Sinhalese jewel merchants and their touts beset and bewilder one with their insistence. "Please come my shop." "Please buy my shop." "Please see great sapphire." "I show you big emerald." "Buy the Ceylon moonstone, lady." "Mine are bluer than his, lady," says No. 6. "I only have the best stones in Ceylon," says No. 7. "Mine only have the trueness blueness," says No. 8. "Please buy; I am poor man, lady," says another, making pantomime of conveying rice grains to his mouth with his fingers.

If the victim escapes the besiegers on the veranda, he only runs into the alcoves of shops further down the hotel fronts, or the blocks of Indian, Burmese, Chinese, and Japanese shops in the blocks beyond. Every day he sees the tourist of simple faith tempted; sees him haggle and struggle and buy, without test or guarantee or any knowledge of his own, rubies and sapphires, cat's-eyes, alexandrites, and emeralds. In time the victim learns that their value is exactly that of cut glass.

If he sits at ease for a moment, snake charmers squat before him and produce their pets like hanks of yarn from such little round sewing-baskets as our grandmothers used, and soon rows of hooded cobras sit up and wave their heads to the squeaky bagpipe airs of their charmers. A slim boy doubles himself into a basket, ducks his head, and the lid is made fast with ropes and the elders thrust swords through and through the basket. The lid is lifted and the boy emerges smiling, while the next juggler plants a mango seed under a bit of cloth, and, when it has grown and pushed the cover high from the ground, one sees the plant with thick rustling leaves still mounting before one's eyes as the grower carefully caresses it.

The native town of long hot streets, with noisy tram cars, lined with untidy, once-white, near-white houses, frescoed with betel-juice stains, is not picturesque; and for interesting drives one goes to the old Cinnamon Gardens and the new park, with its great banyan tree (see page 142), and sees the treasures of ancient art, the jewels, and the weapons at the museum. He drives or takes train for seven miles along shore to Mt. Lavinia, once the marine villa of the governors, then the home of Arabi Pasha, the Egyptian political prisoner, and now a favorite hotel.

In leafy suburbs there are dazzling white dagobas, or reliquaries, and flower-scented temples, where the Buddhist priests wear the same yellow robes, with bared shoulder, and teach the same pure tenets as when Asoka, the Indian Emperor, sent his son and daughter as missionaries to convert the island people. Priests come from other Buddhist countries to study the southern version of the creed at the Oriental College in Colombo.

In the early days of Portuguese and Dutch trade only the ports of Colombo, Galle, Jaffna, Trincomalee, and Battacoloa were known to Europeans, the fierce Sinhalese chiefs holding the hill country against all invasion. When the English drove the Dutch out, in 1796, they soon

NEGOMBO CANAL, MADE BY THE DUTCH, 23 MILES IN LENGTH, CONNECTING NEGOMBO AND COLOMBO

BUDDHIST TEMPLE AND DAGOBA, WITH SINHALESE NUNS AND PRIEST

"In leafy suburbs there are dazzling white dagobas, or reliquaries, and flower-scented temples, where the Buddhist priests wear the same yellow robes, with bared shoulder, and teach the same pure tenets as when Asoka, the Indian Emperor, sent his son and daughter as missionaries to convert the island people."

Photo from Dr. Alexander Graham Bell

OUTRIGGER CANOE

The outrigger is always kept to windward and the canoe sailed either end first. When strong wind blows one or more men sit on outrigger, as in this illustration

Photo and Copyright by Underwood & Underwood

STREET SCENE IN KANDY, CEYLON

"The Sinhalese men, in their straight tight comboys, or skirts, of bright cotton stuffs, look as if the populace were all entered for a sack race" (see page 115)

OUTRIGGER CANOES ON SEA BEACH; MOUNT LAVINIA, COLOMBO: COCOANUT PALMS AT THE EDGE OF THE SEA

Photo and Copyright by Underwood & Underwood

SINHALESE GIRLS AND WOMEN: KANDYAN JACKETS

Note the wonderful luster of the hair. The Sinhalese women, with their brilliant eyes, nice teeth, gentle manners and smiles, are most attractive (see page 117)

SHORE ROAD NEAR COLOMBO, BORDERED WITH COCOA PALMS

pushed their way to the hills and took Kandy, where the native kings and princes had lived in an earthly paradise for more than four centuries, their palaces and temples having strange European resemblances because built by Portuguese prisoners of war. (For map of Ceylon see elsewhere in this number.)

The railway climbs the 75 miles from Colombo to Kandy, and rises 1,680 feet above the sea in three hours, and the transition from palmy suburbs and steaming cocoanut plains to the cool, tea-covered hills is as complete as agreeable. White station-houses are hung over with blooming vines and hedged with tall crotons, hibiscus, oleander, and lantana, and the chattering, good-humored people crowd off and on the trains, buy green cocoanuts to drink and betel nut to chew, and make travel a joyous holiday affair.

One traverses an endless level plain, where vast plantations of cocoa palms and miles of banana farms supply those first necessities of life to the Colombo markets. Down in this low country is the Heneratgoda botanical experiment station, where several varieties of rubber were tested 35 years ago. Since then the planters have taken up rubber culture with such energy that rubber, which ranked after tea, cinchona, and cocoa products, is now first, and may soon equal Brazil's record.

A rubber exhibition was held in Colombo in 1907 to stimulate planters' interest, and a first rubber auction in 1910, when 185,000 acres stood planted to rubber, with 55,000 acres in bearing. Since that year twice as many acres have been planted to Para rubber, tea and coffee bushes have been uprooted to make place for *Ficus elastica,* and in 1911 the export of 4,064,180 pounds of rubber doubled the output of the preceding year.

The great boom in rubber and the wild speculation in rubber shares in 1909 and 1910 sent innumerable investors to Ceylon to look over their spasmodically acquired properties, which, added to an unusual flock of tourists, tested the hotels of the island far beyond their capacity.

KANDY, THE CAPITAL OF EARTH'S PARADISE

Fifty miles out of Colombo the train begins to climb at a gradient of 1 foot in each 45, and in the next 12 miles the whole rise of 1,680 feet is accomplished, the air growing cooler each moment and the view ranging further and further out across valleys of terraced rice fields and hills striped with tea bushes.

Kandy is rightly the capital of the first earthly paradise under the English crown, a place so ideally beautiful and picturesque as to seem but a series of drop curtains. The heart of the town is the great stone walled tank, or artificial lake, which is encircled by a road shaded by magnificent, overarching trees, and along that road by day and night passes a panorama of native life that continually fascinates one. Lean brown priests from the monastery on one side of the lake are continually passing around to the Temple of the Tooth on the opposite shore, swathed in graceful yellow draperies, one shoulder bared and the hand holding a scoop of talipot palm leaf or a yellow umbrella to ward off rain or sun.

The Sinhalese men, in their straight, tight comboys, or skirts, of bright cotton stuffs, look as if the populace were all entered for a sack race; but this hobble skirt is as old as the dhoti of India, the sarong of Java and Malay countries, and it is so suited to the life and the climate that for centuries to come they will continue to wrap themselves tightly in plaid table-cloths and walk with difficult steps. The European white jacket and their own round tortoise-shell comb are worn by all Sinhalese men above the coolie class (see page 111).

The sooty black Tamils, who inhabit the fertile lowlands at the north end of Ceylon, and who come over from the Indian mainland by thousands to work on the plantations, are given to bright red and white draperies and turbans, and their women folk and tiny children are loaded with silver jewelry.

The Arabs and Moormen run to orange and to paids of red and yellow, so that everywhere, in the dazzling sun-

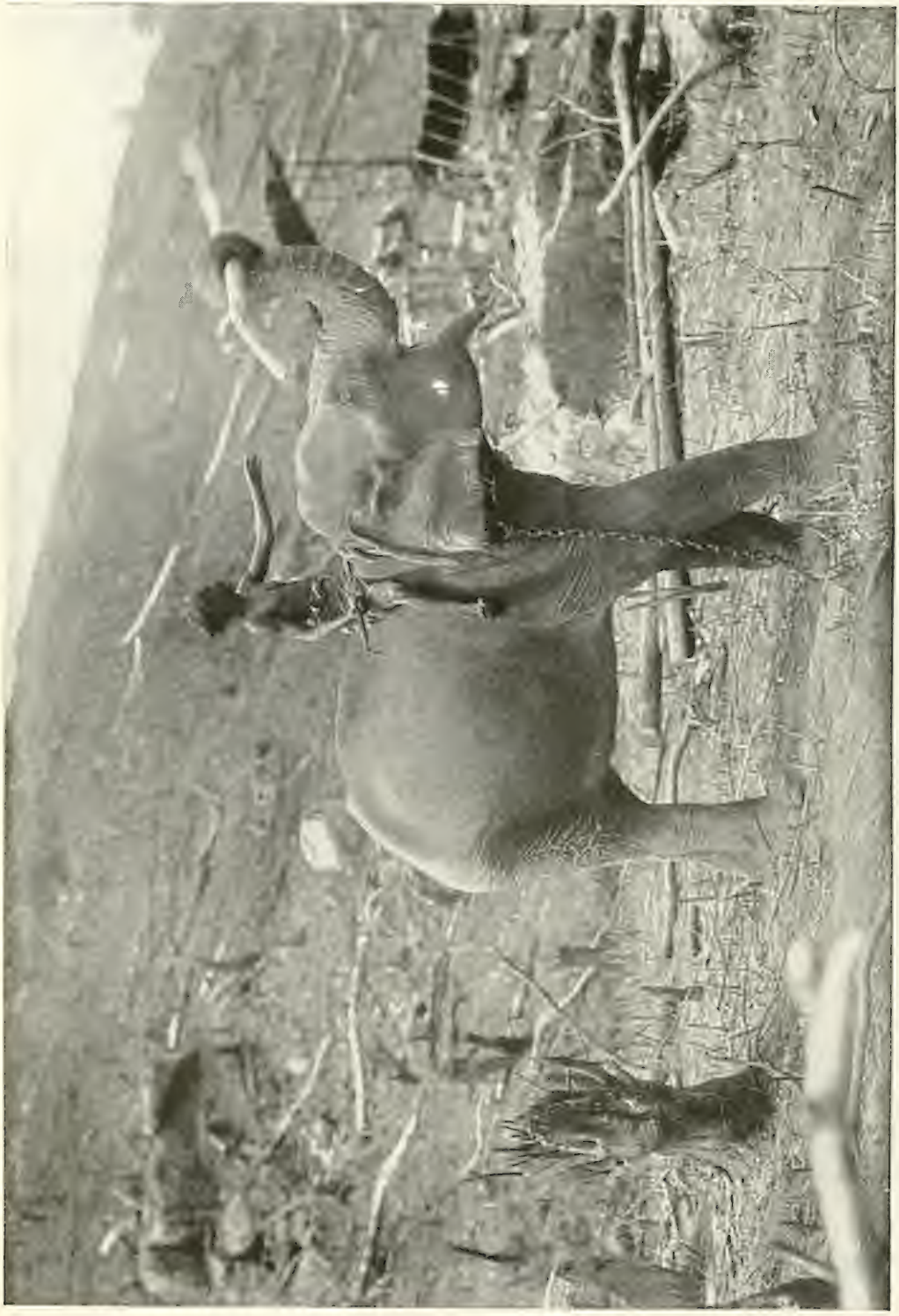


Photo from Dr. Alexander Graham Bell

ELEPHANT CLEARING LAND

shine and against the intense green foliage, one has moving pictures of color and light.

The Sinhalese women, with their brilliant eyes, nice teeth, gentle manners and smiles, are most attractive, and with the tight comboy they wear a tight-fitting basque, lace-bordered and décolleté, evidently of Dutch ancestry, which gives them a festive dinner-party air from sunrise to midnight. They wear necklaces by the dozen, gold beads for first choice, or beads that look like gold, and Venetian glass beads like unto all the gems that go well with bronze skins (p. 113).

It is the Tamil women who are loaded with nose rings and anklets, with rings on their fingers and rings on their toes. The Tamil dancing girls, loaded with real jewels, are matched by the Tamil pickers in the tea fields in tinsel and brass and glass gewgaws.

THE SACRED TOOTH

Chief object of interest at Kandy is the temple or palace of the Sacred Tooth, a relic of the body of the Buddha, which, after many wanderings in India, was sent to Ceylon for safe-keeping early in the 4th century. It was the prize of many wars, and once carried off by marauding Malabars, was recaptured and brought back to Ceylon in the 15th century. The Portuguese seized the tooth in the 16th century, took it to Goa, burned it, pounded the fragments in a mortar, and scattered the dust to the winds from a boat at sea.

That tooth ceased to exist, but the king had a new one made of ivory, large and strong, 20 times the size of any tooth any mortal saint ever had in his head, and built this Dalada Malagawa, or Palace of the Sacred Tooth, up in the hills, where neither marauding Tamils nor white buccaneers could get the molar away. Again and again, as wars were waged with Portuguese, Dutch, and English, the tooth was spirited from its palace and hidden, but since 1815 it has reposed in peace and safety under the British flag. It is taken out once a year, at the time of the great festival and elephant parade at the full moon of August, and is shown to crown princes and visiting potentates with great ceremony.

There is an imposing white entrance beside the lake, and from the first drumbeat at sunrise until the last service at sunset, one sees priests and people crossing the bridged moat and disappearing in the white archway. A cloister surrounds the large stone-paved court which holds the real shrine, a two-story building lavishly carved and gilded and surrounded as with a picket fence with spiked irons for the votive candles. Trays and baskets of flowers overflow at the entrance, where the flower-sellers sit all day disposing of their heavily scented jasmin, frangipanni, gardenia, and oleander garlands and loose blossoms.

IMMENSE STORES OF JEWELS

The worshiper, having cleansed heart and hands and feet at a fountain in a corner of the cloister, brings his candles and his trays of flowers and waits until the priests swing open the heavy silver doors, set in a triple frame of beaten silver, gold, and carved ivory. These precious gates admit to a cool white vault, from which priests and people crowd up a narrow stairway to another small anteroom, and thence through another silver door. This inner sanctum has a silver floor, and silver tables stand before the great jeweled bell of a reliquary which is protected by a glass partition reaching to the ceiling.

This golden dagoba covering the sacred tooth is but the seventh outer covering, each one more richly jeweled than the others and festooned with strings of precious stones. A peacock spreads a tail of rubies and emeralds, and from it hangs the great Kandyan emerald, three inches long and two inches deep. Below that hangs an amethyst two inches long, and the rest of the casket is thick with gems. The innermost cover is almost solidly crusted with rubies.

Besides these in sight, the temple owns great stores of precious stones, and among the elephant caparisons there is one great headpiece for the Tooth's own animal which holds a cat's-eye of heroic size, the largest known.

The breath of many people, the heavily scented air, and the smoke of myriad candles keep the glass partition so dimmed and clouded that one gets slight

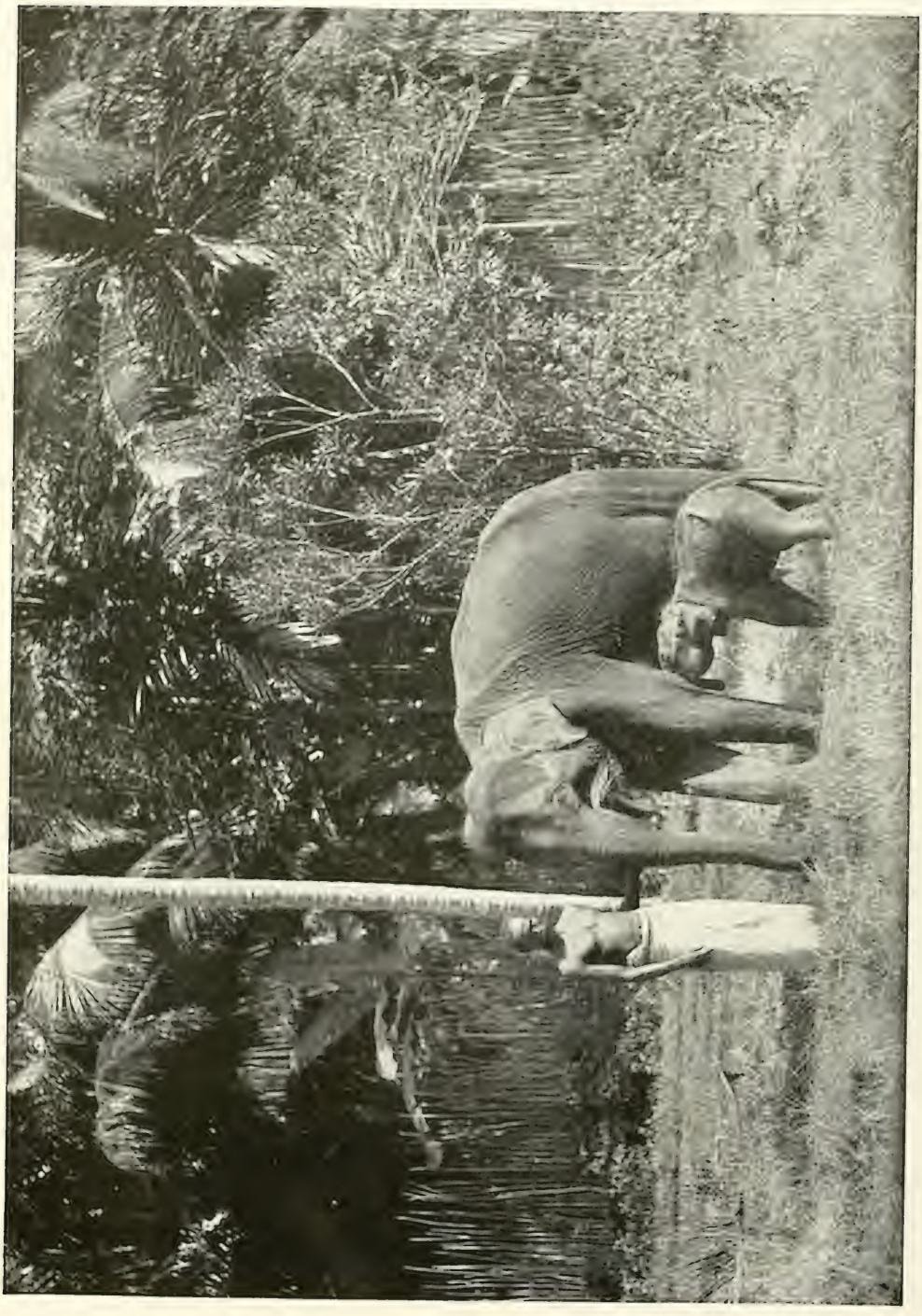
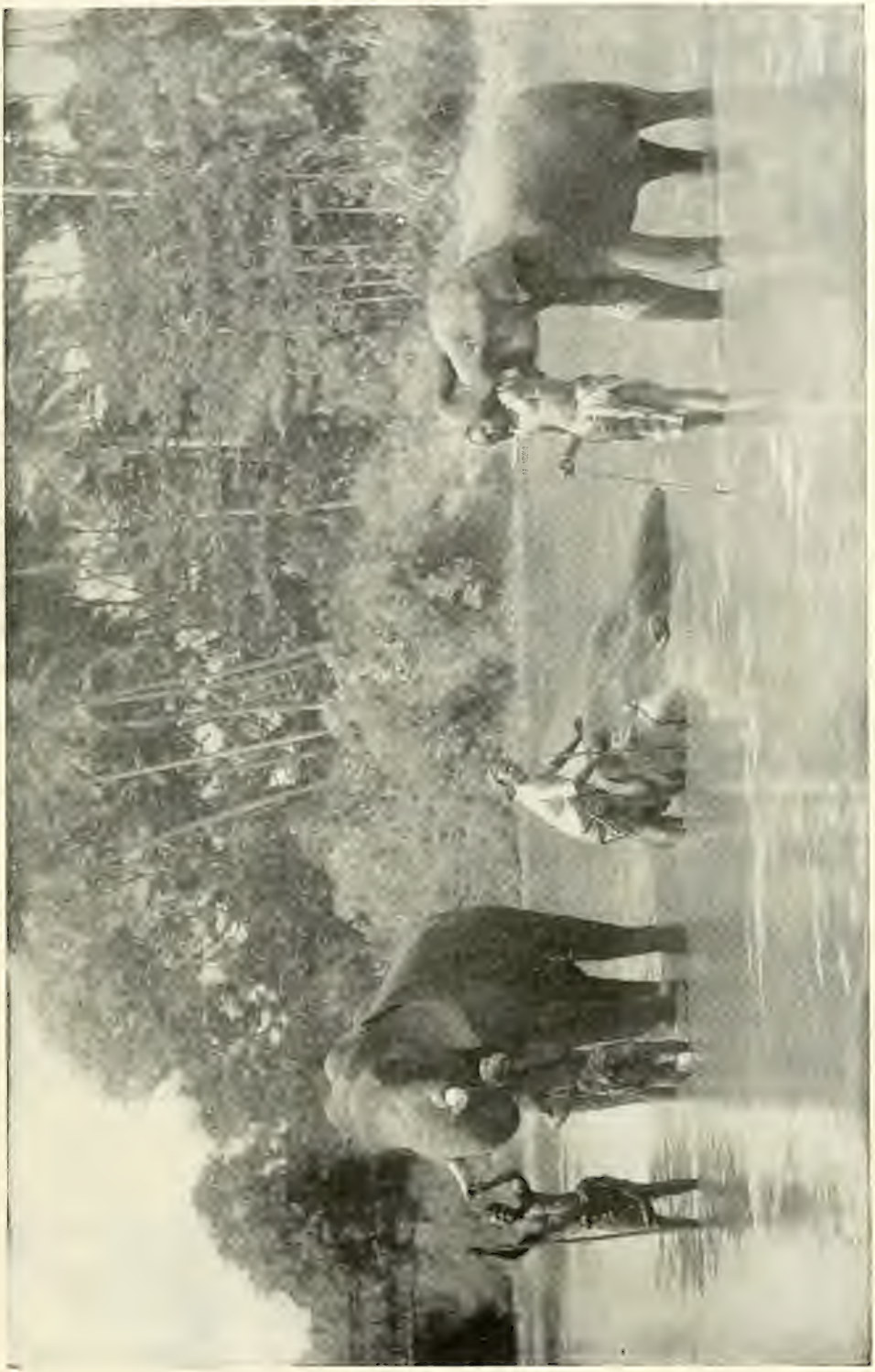


Photo from Dr. Alexander Graham Bell

A BABY ELEPHANT AT LUNCH TIME



ELEPHANTS OF A KANDYAN CHIEF BATHING IN THE MAHAWELI-GANGA, NEAR KANDY

Photo from Dr. Alexander Graham Bell

THE BASKET-TRICK JUGGLER, SHOWING BOY AFTER THE SWORD HAS BEEN RUN REPEATEDLY THROUGH THE BASKET

"A slim boy doubles himself into a basket, ducks his head, and the lid is made fast with ropes and the juggler thrusts sword through and through the basket. The lid is lifted and the boy emerges smiling, while the next juggler plants a mango seed under a bit of cloth, and, when it has grown and pushed the cover high from the ground, one sees the plant with thick rustling leaves still mounting before one's eyes as the grower carefully caresses it" (see page 107).

Photo and Copyright by Underwood & Underwood

SINHALESE CHILDREN: CEYLON

PANDANUS, OR SCREW PALM: CEYLON

Notice the curious prop roots of the two palms shown in this picture The main stem forms these stout roots which grow obliquely downward to the soil. Often the main stem decays near the ground and the tree is then supported entirely by these prop-like roots.

THE JACK-FRUIT TREE

The jack tree is a large East Indian tree somewhat similar but inferior to the bread-fruit. The large fruit is from 12 to 18 inches long by 6 to 8 inches in diameter; often weighing 30 pounds or more. The whole fruit is eaten by the natives, the seeds being roasted. Its chief value, however, rests in its wood, which has a grain very similar to that of mahogany, and although at first very light-colored, it gradually assumes the appearance of that wood.

Photo from Eliza R. Scidmore

THE CANDLE TREE, OR PARMENTIERA

Its original name in India is candle tree, for its peculiar fruit resembles candles and contains 60 per cent of very fat oil, used by natives for lamps and also as candles. They have trifoliolate leaves and rather large greenish flowers with a sheathing calyx.

Photo from Eliza R. Scidmore

TALIPOT PALM TREE, ON WHOSE DRIED LEAVES, OR OLAS, THE BUDDHIST SCRIPTURES WERE WRITTEN

It bears this blossom after the age of 40 years—a splendid spike of white flowers 40 feet high. When the flowers fade the tree dies

Photo from Eliza R. Scidmore

THE SAUSAGE TREE: CEYLON

This is purely a shade and ornamental tree. It is one of the toughest trees known; the fruit is never eaten

impression of the surpassing splendor of this jewel show. While the strangers gape at the treasure heap, the guardians, dressed in old Kandyan costumes—bunchy skirts, short jackets, and flaring turbans—have swept away the offerings of the last ceremony, and the worshipers advance ecstatic and kneel to lay their heaps of white flowers on the silver tables until they overflow and the silver floor is piled deep with blossoms and garlands. The grandest guardian of them all extends a gold tray as large as a table top, on which the alien's offering of a silver rupee looks no larger than an anna or a pice.

In the octagonal library overlooking the lake there is a great collection of sacred books, old Pali texts written on strips of palm leaves and bound in covers of carved ivory, ebony, and sandalwood, beaten silver, and gold. There is also a great literature of modern Buddhism by western writers. Buddhist priests from Burma, Siam, and Japan come to study in this library, and all those strange Occidentals who have adopted the Buddhist faith—Colonel Olcott, Madame Blavatsky, Allan McGregor, and Mrs. Besant—have left their names and taken instruction here, although these rather intelligent and scholarly Kandyan priests smile and shake their heads at the mention of mahatmas, yogis, and all the hocus-pocus of the theosophist offshoots of the northern school.

There is preaching in the temple and chanting of the sacred books on each night of the full moon. On the full-moon nights of June, July, and August—the anniversaries of the chief events in the life of Gautama Buddha, the Great Renunciation, the Great Enlightenment, and the entry into Nirvana—there are greater services, the August festival lasting for a fortnight, with elephant processions every night.

I went one full-moon night to the services in a new temple deep in a dell off Lady McCarthy's Road, at the far end of Kandy. The people were coming and going all night long, and there were stalls for the sale of fruits, rice, and drinks at the gate. Children ran about and played in the temple courts or slept on their mothers' knees.

A circle of priests sat in an inner sanctuary and between dark and dawn chanted the whole text of the Tripitakas, or "Three Baskets" (of wisdom), relays of yellow-robed celebrants succeeding one another every two hours. They chanted in deep, resounding voices, as steady and continuous as the roar of the surf, without break, quaver, or pause, sitting motionless for each two hours' turn. In this same way Buddhist priests have repeated the sacred texts every full-moon night for 25 centuries, the oral version passed on and kept pure in this way.

The drives and walks around Kandy are enough to occupy one for weeks. One drives to far temples on picturesque hills and pinnacle rocks, to tea estates, to the Botanical Garden, and to the river bank every afternoon to watch the temple elephants enjoy their bath and a water carnival. New roads are always being made, and Lady McCarthy's Road, Lady Gordon's Road, Lady Longden's Drive, and Lady Blake's Drive are named for as many chatelaines of Government House, who interested themselves in developing the beauties of Kandy. Lady Horton's Walk is more fascinating than them all, and strikes straight up the forested hillside back of the King's Pavilion into an enchanted jungle, winding far around on the hills, with views out and down on the lake and the town.

The Peradeniya Gardens, four miles away, present every beautiful and useful tree, plant, and flower that will grow in this ideal climate of eternal June. One walks in wonderland down one avenue of giant rubber trees, along another of royal palms, past groups of talipot, palmyra, and soaring areca palms, gigantic fans of travelers' palms, clumps of giant bamboo soaring a hundred feet in air, groves of nutmeg and cinnamon trees, ponds of victoria regia, thickets of tree ferns, mats of blue iridescent ferns, and long borders of sensitive plants.

The orchid-house delights one, with all its hundreds of baskets and pieces of mossy branches hanging in the open air, only mat awnings sheltering the treas-

Photo from Dr. Alexander Graham Bell

A TAMIL GIRL OF CEYLON

Photo from Dr. Alexander Graham Bell

A YOUNG TAMIL OF CEYLON

Photo from Eliza R. Scidmore

CLUMP OF GIANT BAMBOO (OVER 100 FEET HIGH) BY THE RIVER BANK IN PERADENIYA GARDENS

These Malacca bamboos are 9 inches in diameter and sometimes grow a foot a day during the midsummer rains. The immense size of this clump is indicated by the small human figure

Photo and Copyright by Underwood & Underwood

ASSAM RUBBER TREE: PERADENIYA GARDENS, KANDY (SEE PAGE 127)

"The Peradeniya Gardens, four miles away, present every beautiful and useful tree, plant, and flower that will grow in this ideal climate of eternal June. One walks in wonderland down one avenue of giant rubber trees, along another of royal palms, past groups of talipot, palmyra, and soaring areca palms, gigantic fans of travelers' palms, clumps of giant bamboo soaring a hundred feet in air, groves of nutmeg and cinnamon trees, ponds of victoria regia, thickets of tree ferns, mats of blue iridescent ferns, and long borders of sensitive plants."

DAUGHTERS OF A KANDYAN CHIEF

Photo from Dr. Alexander Graham Bell

A TAMIL WOMAN OF CEYLON: NOTE THE RINGS ON HER TOES

TAMIL WOMEN AT JAFFNA: NECKLACES OF COINS AND BEATEN GOLD

ured ones that hide in the farthest and darkest jungles.

A bare tree hanging full of strange black fruits proves to be only the sleeping place of a colony of "flying foxes," or huge bats, that fly by night and at sunrise grip a tree branch by one foot, fold their 24-inch-long wings, and, hanging head down, sleep the whole day away.

THE FOOTPRINTS OF BUDDHA

The railway carries one up to Hatton, 4,141 feet above the sea, in the next 30 miles, into the heart of the oldest tea district, that was a great coffee district before the blight of 1870 ruined that greatest industry of the island. There is a splendid view of Adams Peak from Hatton, and one may drive across the hills all striped with round tea bushes, shaded by grevillea, or rubber trees, and following the banks of the beautiful Maskeliya reach the foot of the peak. Then comes a few miles on pony or chair, and after that serious climbing the last part a stiff pull up over sheer rock faces by the aid of heavy iron chains that have been there for ages. There is barely room for the tiny temple over the sacred footprint of the Buddha, 7,353 feet above the sea.

Believers of three creeds have made the pilgrimage and met there for centuries without any discord or such unseemly behavior as when two sects of Christians meet in Jerusalem. All aim to reach the summit at sunrise, when the great shadow of the peak is thrown upon the sky as at the Brocken and the view ranges far over Ceylon and to the ocean.

The Buddhists believe that Gautama Buddha, who came to Ceylon in a storm cloud, landed on this peak, and they celebrate that event every April, with the elaborate footprint in the solid rock the sufficient proof. The Hindus, or Tamils, believe that Siva stood there on the summit when he stirred the sea with his trident. The Mohammedans believe that Adam once stood there, and the Catholics have tradition of St. Thomas having visited the peak.

From Hatton the railway climbs another thousand feet in a run of 20 miles through a continuous tea district, all the hills cleared and planted in orderly rows of bushes, guarded by their attendant, thin-foliaged shade trees, and 50,000 acres of tea bushes are always in sight from the train. Tea will thrive everywhere from sea-level to 7,000 feet, but the best plantations are between 2,500 and 4,500 feet above the sea.

All land above 5,000 feet is now reserved as crown forest land, and ebony and many valuable woods are being replanted after the centuries of spoliation.

At Nanu Oya station one changes to a primitive, bone-breaking train of tram cars, the toy cars, and the absurd little vehicles jolt and rumble and threaten to buckle in air whenever the brakes are applied. The busy little engine pants up another thousand feet in the four miles and lands one at the great upland resort of Nuwara Eliya, "Nurelya"—as our English cousins shorten it in pronunciation.

This most ideal summer resort, 6,210 feet above the sea, offers one grate fires every evening and morning and blankets every night, and meanwhile flowers bloom with California profusion in the many beautiful bungalows that surround the wide ellipse of a level valley, where club-houses, a race-course, and golf links minister to a Briton's necessities. The Governor has a summer home; there are hospitals and sanatoriums.

At the mouth of the valley lies the Hakgalla Botanical Garden, where one sees the most wonderful tree and all other ferns in this chosen region of tree ferns. The huge fronds show on every hillside and in every gully, and they used to be the favorite food of the herds of wild elephants that roamed here and nipped out the juicy but at the heart of the fern.

The gardens command a magnificent view, and over a great amphitheater of tea-clad hills and valleys and straight across on the opposite hills show the galvanized-iron sheds, where some 1,800 hale and hearty, strapping, big Boer prisoners were fed and fattened in idleness for more than a year after their surrender in South Africa. The slow Sinhalese brain could not understand that absurdity, for in their wars they either knocked their prisoners on the head,

Photo from Dr. Alexander Graham Bell

STAIRCASE OF 1,840 GRANITE SLABS LEADING TO THE TOP OF MIHINTALE, THE SACRED MOUNTAIN

This is where Prince Mahinda, son of the Emperor Asoka, arrived in 307 B. C. to preach Buddhism. Mahinda lived there to the end of his life, and the whole mountain is covered with ruins of sacred edifices (see page 145).

Photo and Copyright by Underwood & Underwood

VIEW OF THE KANDYAN COUNTRY, LOOKING TOWARD THE MATALE HILLS: NOTE THE RICE TERRACES AND MEN AT WORK IN THEM

Photo and Copyright by Underwood & Underwood

THE SITTING BUDDHA AND ELABORATELY DECORATED SHRINE: LANKATILAKA TEMPLE, 11 MILES FROM KANDY, A MOST PICTURESQUELY PLACED SHRINE ON THE TOP OF AN ISOLATED ROCK

Photo from Dr. Alexander Graham Bell

TREE FERNS

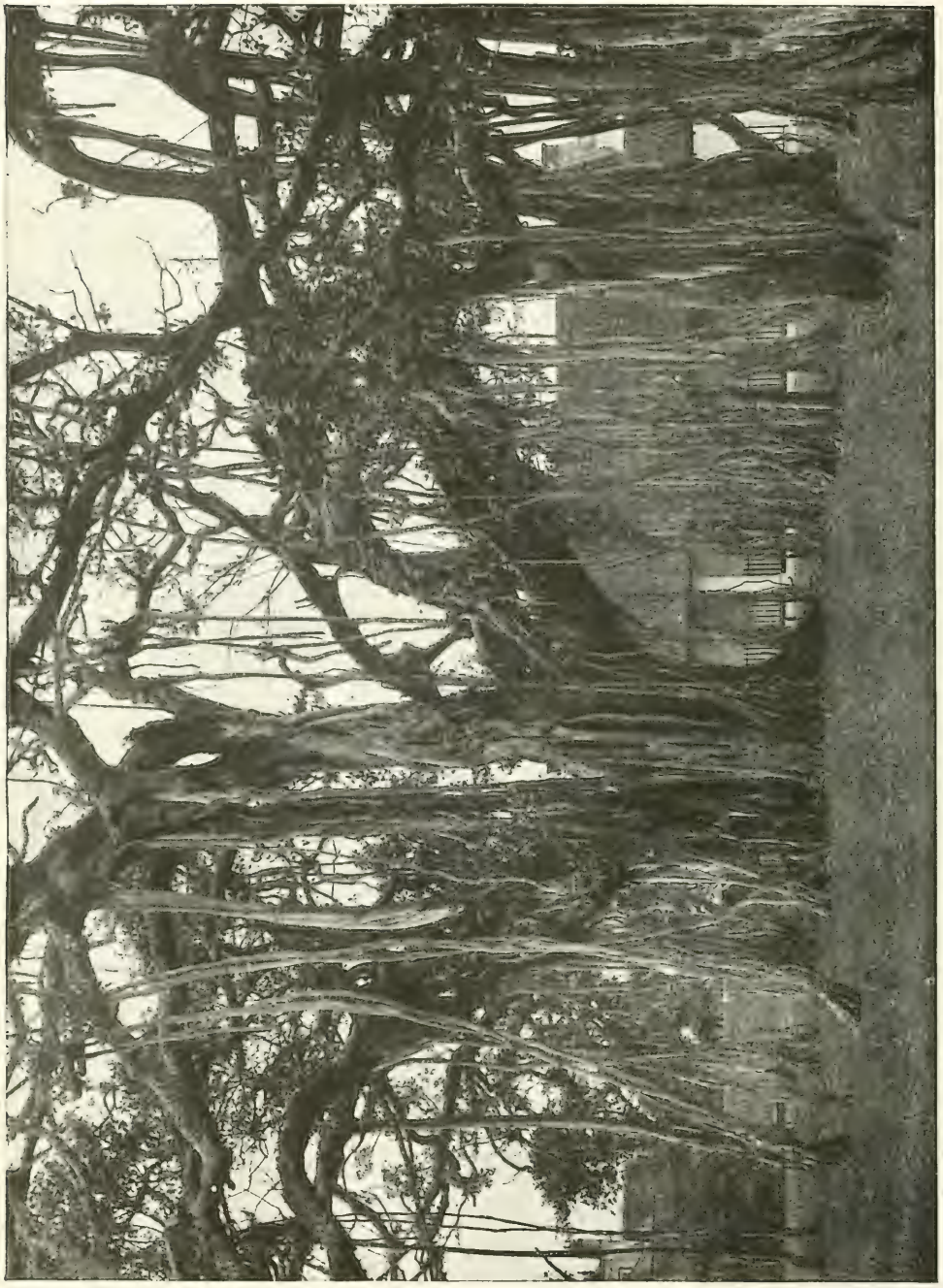
"At the mouth of the valley lies the Hakgalla Botanical Garden, where one sees the most wonderful tree and all other ferns in this chosen region of tree ferns. The huge fronds show on every hillside and in every gully, and they used to be the favorite food of the herds of wild elephants that roamed here and nipped out the juicy but at the heart of the fern."

Photo from Dr. Alexander Graham Bell

TAMIL GIRL: EASTERN PROVINCE OF CEYLON

Photo from Dr. Alexander Graham Bell

A SINHALESE GIRL OF CEYLON



THE BANYAN TREE (*Ficus indica*) IN THE GARDENS OF COLOMBO (SEE PAGE 107)

Photo from Dr. Alexander Graham Bell

TAMIL WOMEN AND CHILDREN

IMAGES IN OUTER CORRIDOR OF THE BUDDHIST TEMPLE AT KELANI, A SUBURB OF COLOMBO

brayed them in mortars, or tortured them in gentler ways, or set them to work building palaces for their captors.

The best excursion from Nuwara Eliya is to the summit of Pidurutallagalla, or "Pedro" for short, which rises from the other side of the golf links a steep 2,000 more feet in the air. The strenuous ones walk up a well-chosen path, with benches at the best lookout points; the wise conserve their wind by riding in rickety chairs, and the start is always made before daybreak in order to reach the summit at sunrise.

It is an enchanting trip at dawn up through the forest of rhododendron trees, bearing many orchids, with thick mosses and hanging mosses glittering with the heavy dews. From the cairn on the open summit (8,296 feet) the eye sweeps over mountain tops and green hills down to the lowland plains and the sea. Adams Peak lies below one, and the hazy ocean lies around the great relief map. In a few minutes the distances and the lowlands are lost in the heat haze of the day.

WONDERFUL RUINS AND CAVES

One of the most beautiful drives in Ceylon is the 12 miles from Kandy to Matale, and thence on down to Nalanda and Dambool, at the edge of the low country that constitutes the northern half of the island. Every hill is striped with tea bushes, and avenues of pepper, tamarind, and rain trees shade the perfect roads that pass cacao plantations by the mile.

One stops outside Matale at the Alu Vihara, in the shade of and hollowed out in the ledges of a most remarkable group of detached rocks. There is an image of the sleeping Buddha some 18 feet long and a great footprint in the rock. In 90 B. C. the king convoked the assemblage of priests and bade them reduce to writing all the teachings of the Buddha, which up to that time had been handed down orally, the convocation of priests in every rainy season repeating the teachings day after day in unison, and in that way keeping pure the version brought to the island by the missionary prince Mahindo, son of the Emperor Asoka, the Constantine of Buddhism.

At Dambool, 60 miles from Kandy, there is a great outcropping of gneiss, which slopes steeply upward for 600 feet on one side and rises as a sheer precipice from the plain on the other face. An undercut ledge near the summit of the rock face was availed of 2,000 years ago by a hermit, and a fugitive king, whom he sheltered in the cave home, later fulfilled his vows and excavated a vast chamber in the rock and two smaller caves and richly endowed this religious establishment. There is a fortified gateway as entrance to the high terrace of a ledge, which holds a bell tower and a bo-tree.

In the large cave cathedral there is a heroic rock-cut image of the Buddha standing on the long altar table of living rock, and 53 seated images meditate in the moist perfumed air.

A central dagoba is cut in one piece with the solid floor, and the rock roof and inner walls are painted with religious subjects in a strangely broad and simple, almost primitive, style that one would not be surprised to find in an old Tuscan monastery (see pages 148 and 149).

The procession of saints, each with a golden nimbus, would be recognized as the work of a brother, had Giotto or Cimabue ever come to Dambool. The fronts of the caves are closed in with walls, and the small shrines have dirty Nottingham lace curtains, tawdry ornaments, and greasy brasses that greatly detract from the impressiveness of the place.

From the summit of Dambool rock one sees only level jungle to north and east and west, Sigiri's rock fortress rising like a lighthouse from the unbroken green.* There are 40 miles of level carriage road between two walls of foliage, with only a dreary village here and there, all the way to Anuradhpura. The plains seem hot and steamy to one coming down from the cool air of the hills, and in the old posting days we had to leave Matale before daylight to accomplish the 70-mile drive at dusk, changing horses six times. Now, with a railway direct from Colombo, one can get there in six hours,

* See article "Archeology in the Air," in the NATIONAL GEOGRAPHIC MAGAZINE, March, 1907.

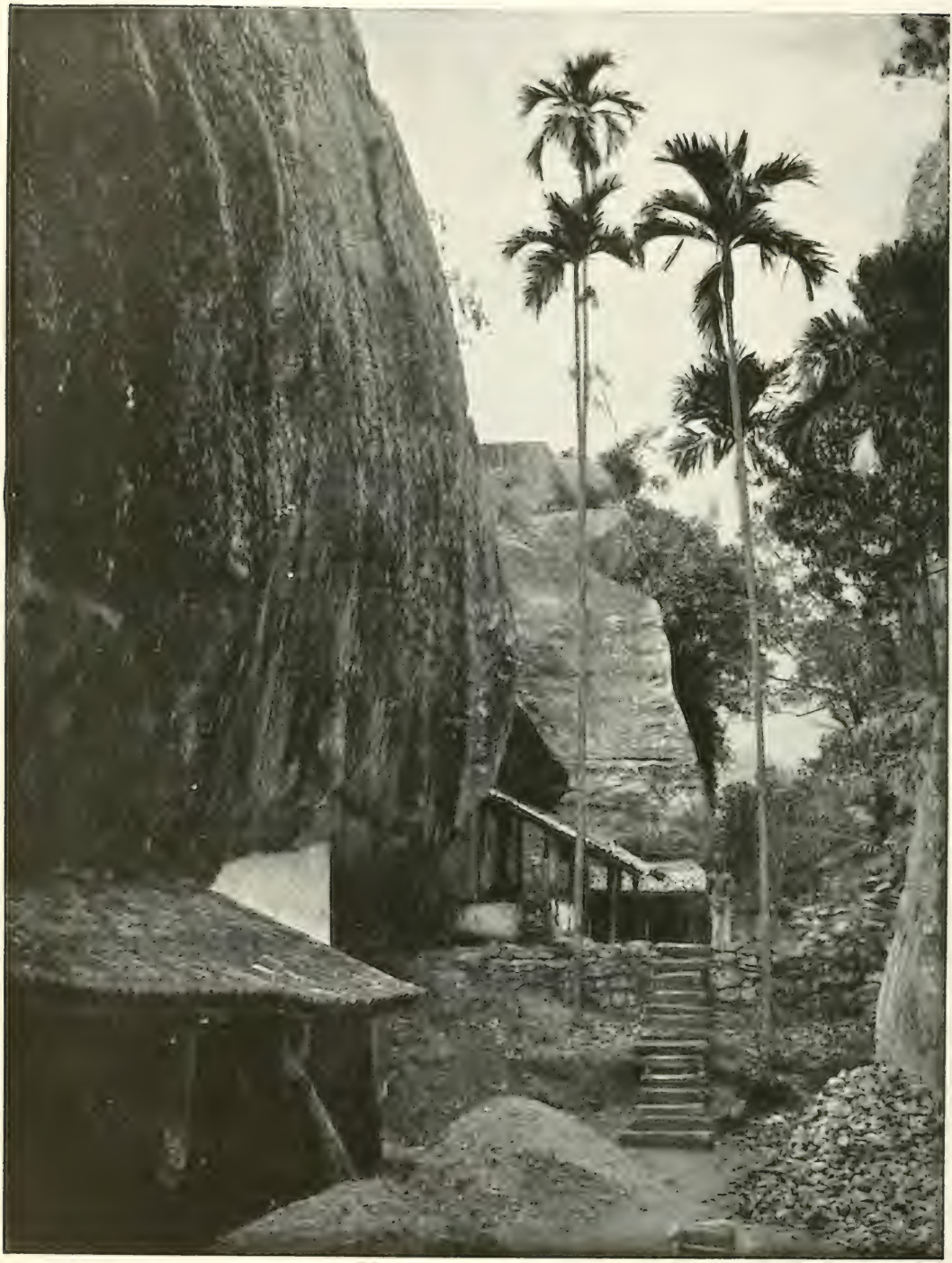


Photo from Eliza R. Scidmore

THE ALU VIHARA, A CAVE TEMPLE AND MONASTERY NEAR MATALE, WHERE THE BUDDHIST TEACHINGS WERE FIRST PUT IN WRITTEN FORM, ON PALM LEAVES, IN THE FIRST CENTURY B. C. (SEE PAGE 145)

or by automobile it is only a morning's run over roads worthy of a London park.

One admirable English officer gave his life, 50 years of it, to perfecting the road system of Ceylon. He constructed 3,000 miles of highways, maintaining a standing army of 3,000 or 4,000 road coolies specially trained to that work. It was wisely ordered from the first that every adult male should give six days' labor, or its equivalent tax, for road-making. That policy, pursued since 1848, has resulted in a perfection of such means of communication as fills an American with envy.

One meets nothing all day but Tamils from the Jaffna end of the island or the Indian mainland, walking to the hills for employment on the great estates—poor, spindly, weedy looking creatures of inkiest blackness, to whom the Ceylon hill country is like an America of opportunity and high wages. The average pay of 10 and 16 United States cents a day on the tea plantations is three times as much as they can earn in India; and, in addition, they are housed, given medical care, and schools provided for their children.

Once we saw an elephant devouring the yellow flowers of a mango tree, but his keeper was lolling in the shade; and again a jungle cock flashed across the road to the shelter of bushes hung with the gorgeous red and yellow *Gloriosa superba,* the most splendid tropical flower that grows, and quite deserving its extravagant name. Butterflies danced in clouds down the empty road—large tropical butterflies with great wings of prismatic sheen, and the common little yellow cabbage butterflies that are one of the three things found in every country and climate the world over, the others being the Norway rat and the Chinese.

Photo from David Fairchild

A KANDYAN KING: CEYLON

THE GLORIOUS CITY OF ANURADHPURA

All this lowland half of Ceylon was once thickly populated, and the city of Anuradhpura, founded at the time of the Aryan invasion, 2,500 years ago, was one of the richest and greatest cities of the East. Its real history began with the arrival of the Buddhist missionaries from India in 245 B. C. and their planting of the sacred Bo tree, a branch from the tree under which Buddha sat when he attained Buddhahood. There has been continuous record kept of the ceremonies and festivals connected with the tree from that day to date—when walls were built, when branches were lost, of the festivals of lanterns at the watering time in each dry season—princely monks minutely

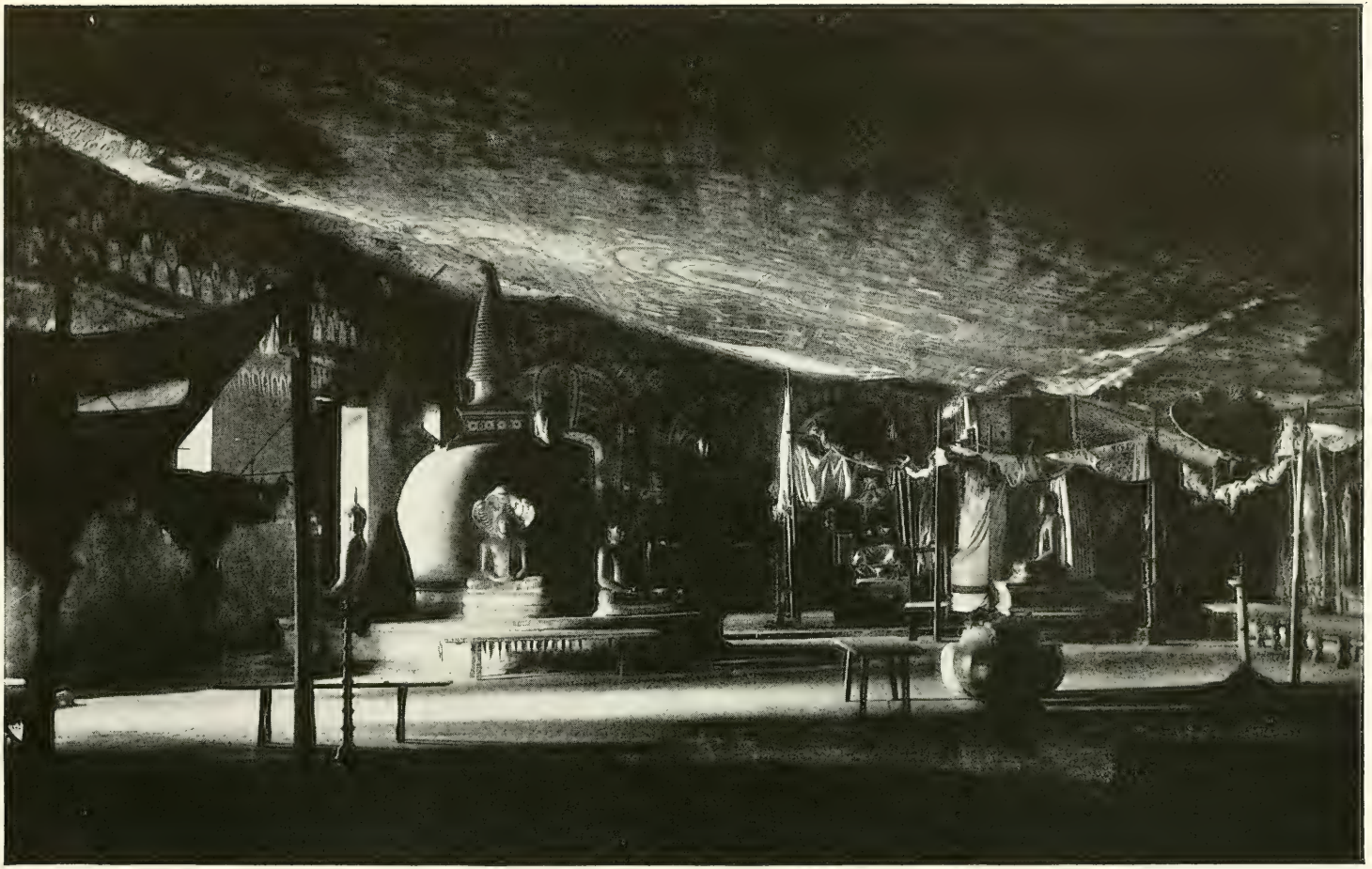


Photo from Eliza R. Scidmore

A NATURAL CAVERN IN THE GREAT ROCK OF DAMBOOL, WHERE KING WALAGAMBAHN TOOK REFUGE IN THE FIRST CENTURY B. C.: ENLARGED LATER

Frescoes on walls and natural rock ceiling nearly 2,000 years old. This cave temple measures 150 feet by 60 feet, and the roof is 23 feet high at the entrance. The large dagoba is solid rock, still joined to ceiling and floor

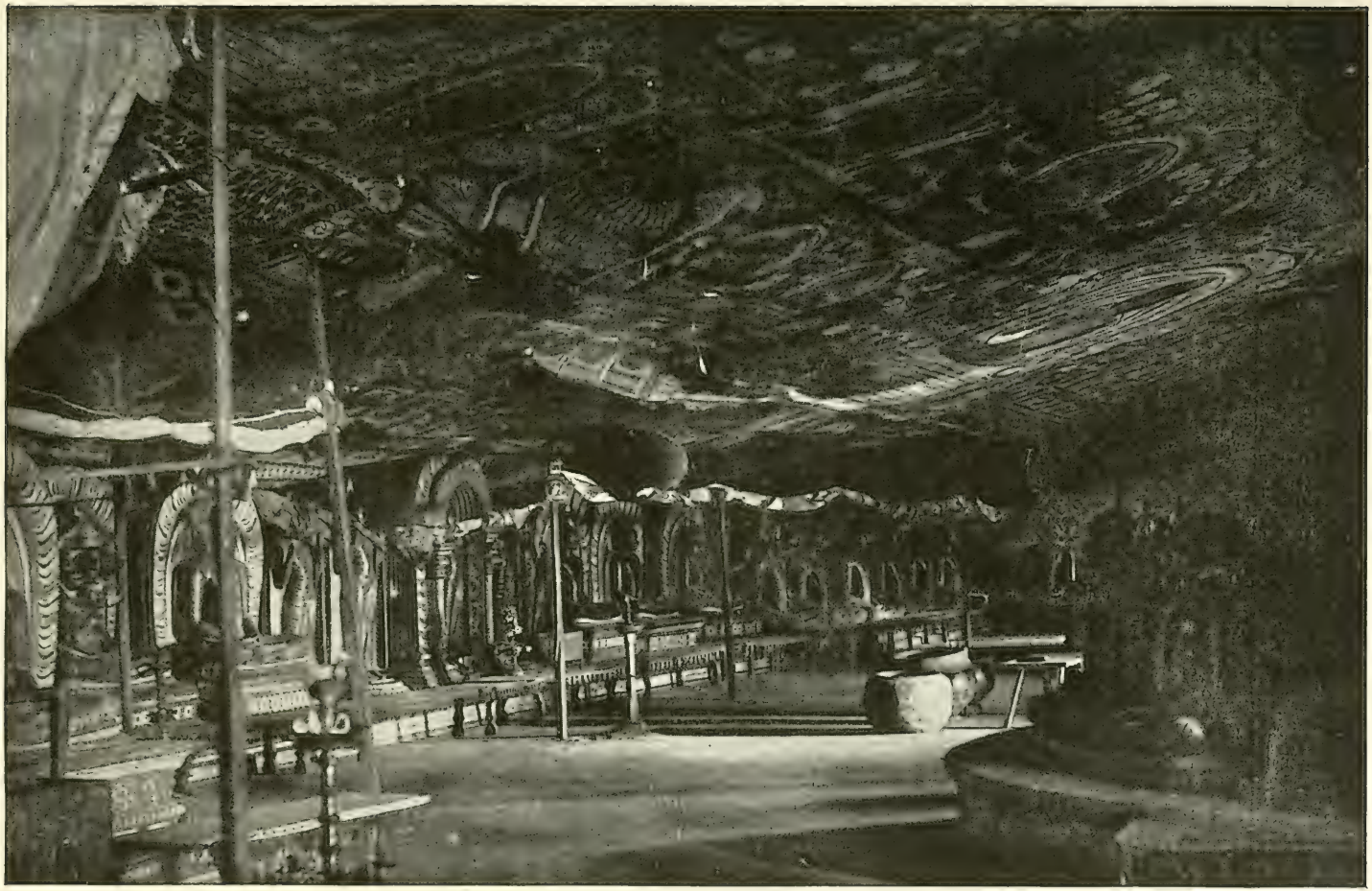


Photo from Eliza R. Scidmore

REAR OF THE GREAT CAVE TEMPLE IN THE ROCK OF DAMBOOL, WITH STATUE OF KING WALAGAMBAHN AND 50 IMAGES OF BUDDHA

The rock walls and roof are entirely covered with frescoes of historic scenes in Sinhalese history (see page 145)

Photo from Dr. Alexander Graham Bell

PRIEST AND ACOLYTES OF THE TEMPLE OF THE TOOTH AT KANDY (SEE PAGE 117)

Photo and Copyright by Underwood & Underwood

STUDENTS FOR THE BUDDHIST PRIESTHOOD AT THE DALADA MALAGAWA, TEMPLE OF THE TOOTH: KANDY, CEYLON (SEE PAGE 117)

Photo from Dr. Alexander Graham Bell

REMAINS OF THE BRAZEN PALACE AT ANURADHPURA, A BUDDHIST MONASTERY

It was nine stories in height, 100 cubits square, and rested on these 1,600 granite columns. It was covered with brazen tiles, and was built by King Dretthagamini in 164 B. C. A great civilization was at its height in Ceylon when Christ was born. Anuradhpura, the capital, occupied about 100 square miles in a fertile plain; it harbored 96,000 Buddhist priests. Water was brought from the mountains, 40 miles distant, in a huge canal and stored in large artificial lakes.

chronicling Sinhalese history at the one monastery down to the time of the British conquest.

The sacred Bo tree has always been an object of reverence and pilgrimage, and it never suffered during the many wars and invasions. It stands in a large enclosure with an entrance gate, and looms up a mountain of dancing, dark-green, glittering leaves.

Triple terraces, or altar-tables, surround the mighty trunk and protect the Tree of Wisdom, as at Buddh-Gaya, from the extraordinary offerings of the faithful. A legion of wanderoo monkeys live in the tree and subsist on the fruit and flowers and food-offerings of pilgrims. Languid brown priests receive more solid contributions and permit Burmese worshipers to daub ochre and gold leaf on the walls.

A grove of its descendants surrounds the original tree, and each shining, heart-shaped leaf, with its long, tapering, tendril, perpetually spins and trembles on its long foot stalk—trembles in reverence for the one who became the Buddha beneath its branches. Each leaf is a prayer, a sacred talisman, and pilgrims prostrate themselves before a fallen leaf and reverently lift and carry the treasure away.

When I went back to the tree, late on a rainy November afternoon, to gather more of the great leaves—which are two and three times the size of the leaves of the Buddh-Gaya tree—only a mite of a Tamil horse-boy from the resthouse went along. The troops of monkeys fled from the tables of offerings to the tree branches and sat there staring and gibbering.

When I stooped to pick up a leaf they dropped to the terraced altar. When I moved they moved, dropping down and down, alighting on the stone flags so silently on their pneumatic feet that before one could realize it the court was full of mouthing apes that swung threatening arms, as they hopped nearer and nearer, until flight was best.

When Anuradhpura was a city measuring 16 miles from north gate to south gate, and there were 11,000 houses on that one street, there were palaces and temples and monster dagobas to match; and, after being razed and rebuilt, after several wars it attained its height in the 12th century. At that time the Sinhalese overran southern India and carried their victorious excursions as far as Cambodia; but when the Tamils retaliated, a century later, the whole of northern Ceylon was laid waste. Cities were destroyed, tanks were broken, and the people massacred or carried into captivity. The country soon went to jungle, with a few villages and lone temples existing by the swamps that once were tanks of clear water. British rule has revived the region, roads have been cut through, tanks rebuilt, and the land cultivated once more. With the railway and the rubber boom, and irrigation, the prosperity of the low country is assured.

Along with this economic salvation British archeologists have done an enormous work in uncovering, making accessible, and making known these wonderful monuments of the early century. Mihintale, the sacred pinnacle peak eight miles from Anuradhpura, is strewn over with temples, tanks, shrines, and alcoves where saints and hermits dwelt. Pollonaruwa, 50 miles across the jungle from Dambool, was the capital from the 8th to the 13th century, and in the great area of ruins there are many buildings better preserved than at Anuradhpura, with far more elaborate sculptures (see pages 136, 159, and 160).

The first railway from Colombo to Kandy was opened in 1869, and although immensely profitable to the government, it was forty years before it was continued the 200 miles to Jaffna, at the north end of the island. One looks impatiently at the map where the large islands of Manaar and Paumben are almost joined by the chain of islands known as Adams Bridge—our forefather, it is said, having gone by this route to Mecca to bring Eve to the new home in Ceylon. The passage between Ceylon and Manaar is so shallow that it can be forded, and that between Paumben was once dredged to accommodate vessels drawing ten feet, with such disastrous results to the pearl fisheries that it will probably never be attempted again.

A railway from Ceylon to the Indian

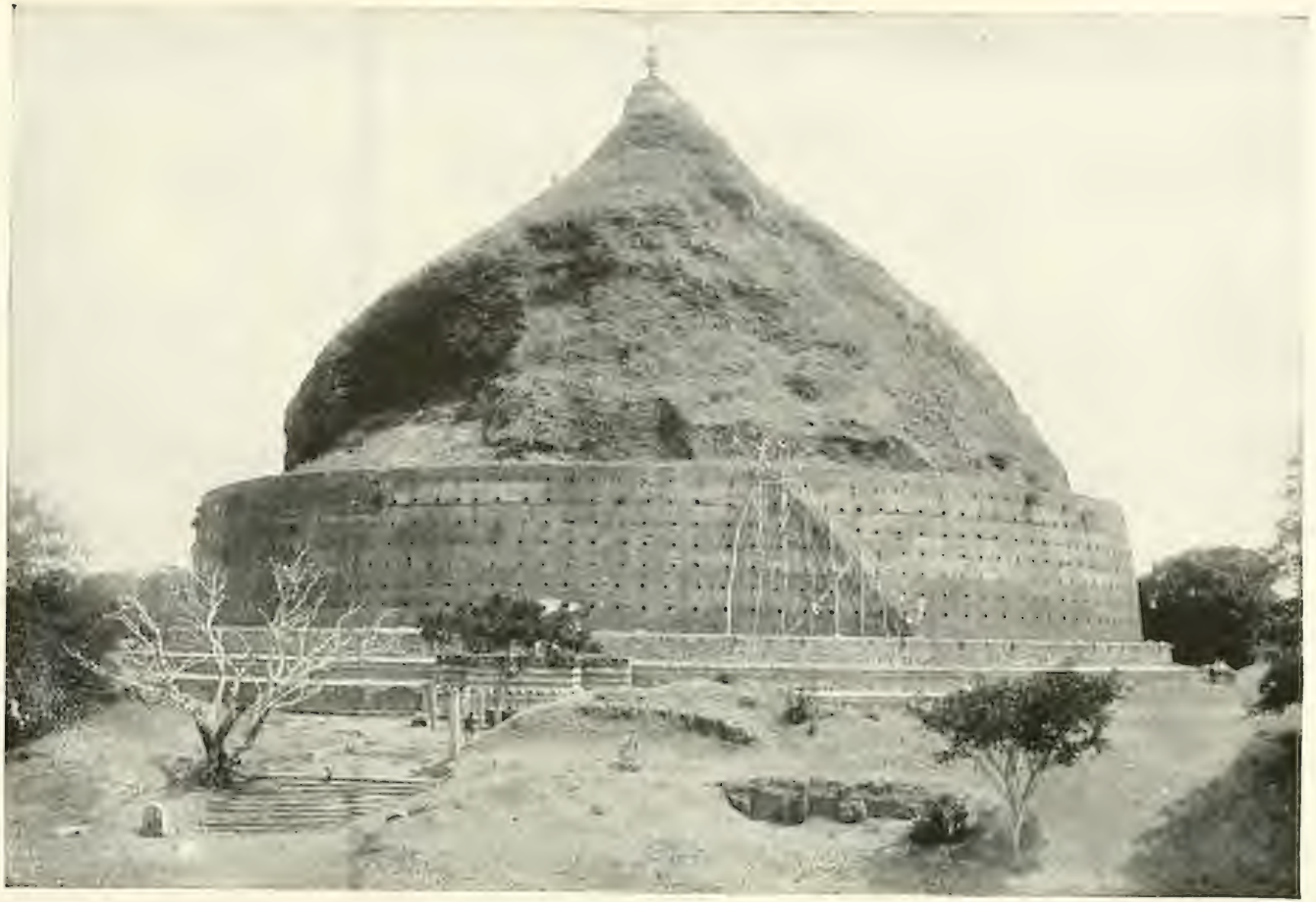
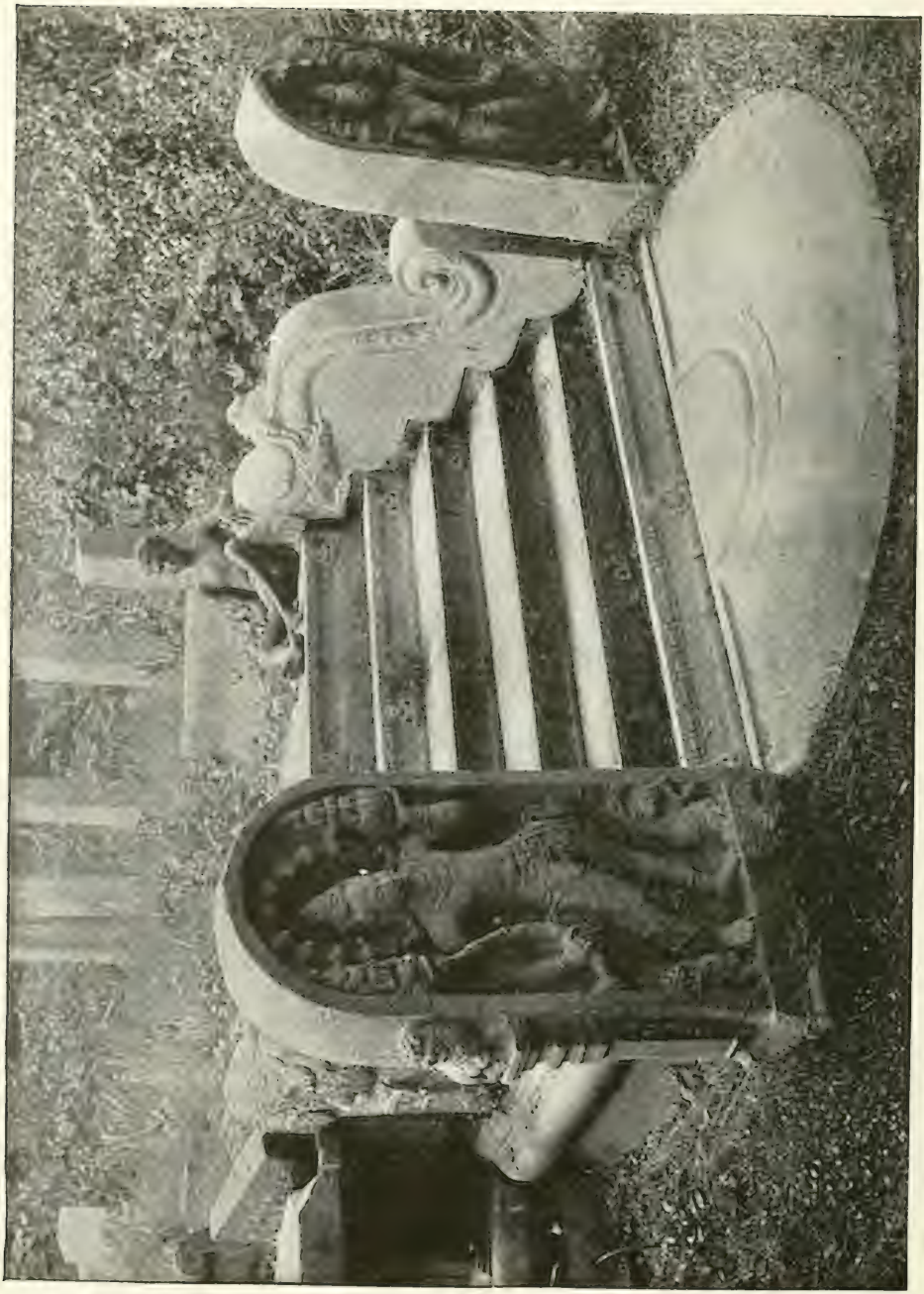


Photo from Dr. Alexander Graham Bell

RUANWELI DAGOBA, ANURADHPURA, A SOLID MASS OF BRICKWORK 200 FEET HIGH

Formerly over 350 feet high, with processions of caparisoned elephants of *Chiwara* ranged on the lower terrace, and covered paths on each terrace for festival processions. A great portico or temple covered the main altar or place of offerings. There are four of these huge bee-hives of solid brick in Anuradhpura. They were constructed by kings to commemorate different events. The dagoba shown in this picture contains sufficient brick "to raise 8,000 houses, each with 20 feet frontage, and these would form 30 streets each half a mile in length."

STATUE OF KING DUTTHAGAMINI, THREE BUDDHAS, AND KING BATIYATISSA I, EXCAVATED FROM RUINED HALL AT BASE OF THE RUANWELI DAGOBA, WHICH IS SHOWN ON PAGE 154: ANURADHPURA. EACH STATUE IS ABOUT 10 FEET IN HEIGHT



FLIGHT OF STEPS, WITH GUARDIAN STONES AT EITHER SIDE AND "MOONSTONE" AT FOOT OF STEPS: ANURADHPURA

SEMI-CIRCULAR "MOONSTONE" AT FOOT OF STEPS: ELEPHANT, HORSE, LION, AND BULL SCULPTURED ON OUTER RIM, WITH LOTUS DESIGNS AND THE HAUSA, OR SACRED GOOSE, AND LOTUS PETALS AT CENTER

These beautiful semicircular stones, of exquisite design and workmanship, have been found before many of the buildings at Anuradhpura

THE PALACE OF SEVEN STORIES, OR SAT-MAHAL-PRASADA, AT POLONNARUWA

Its origin and purpose are unknown. An outer staircase leads to the second terrace only; inner staircase to second level only

Photo from Dr. Alexander Graham Bell

STATUE OF KING PARAKRAMA THE GREAT, AT POLONNARUWA: CARVED ON THE FACE OF A SOLID ROCK RISING FROM THE PLAIN

He reigned for 33 years in the middle of the 12th century, drove out the Tamils, invaded India, and built this splendid city (see page 163)

THE SLEEPING BUDDHA, AT POLONNARUWA: CARVED FROM SOLID ROCK

The image is 80 feet in length and was formerly covered by a great temple. These huge statues and images, hewn out of the living rock, are very common in Ceylon

FLOWERS AND BUDS OF THE TEA PLANT

The Chinese say that the virtues of tea were discovered by their remarkable Emperor, Chinnung, 2737 B. C., to whom they ascribe all agricultural and medicinal knowledge. Although many of the products of China were brought to Europe and used by Europeans in very early times, we have no records of the use of tea in Europe earlier than 1588 A. D. The English did not begin to use it to any extent until about 1700, when the price of tea ranged from $25 to $50 per pound.

PLANTING A TEA SEEDLING: CEYLON

The tea tree is propagated entirely from seeds, the seed of the tea being slightly larger than a hazelnut. When the seedling is about seven or eight months old it is planted, as shown in this illustration. It grows to four or six feet high in two years, when it is cut down almost to the ground. The first picking does not take place until the third or fourth year. The average tea tree lives for 50 years, though it is said that there are records in China of trees attaining 300 and even 400 years.

PICKING THE TEA LEAVES

All the picking is done by women and girls, Tamils who come from India to work on the tea estates. The picking begins about the end of April and usually lasts until the end of November. Only the tip of the shoot and soft leaves are picked

SORTING THE TEA LEAVES: CEYLON

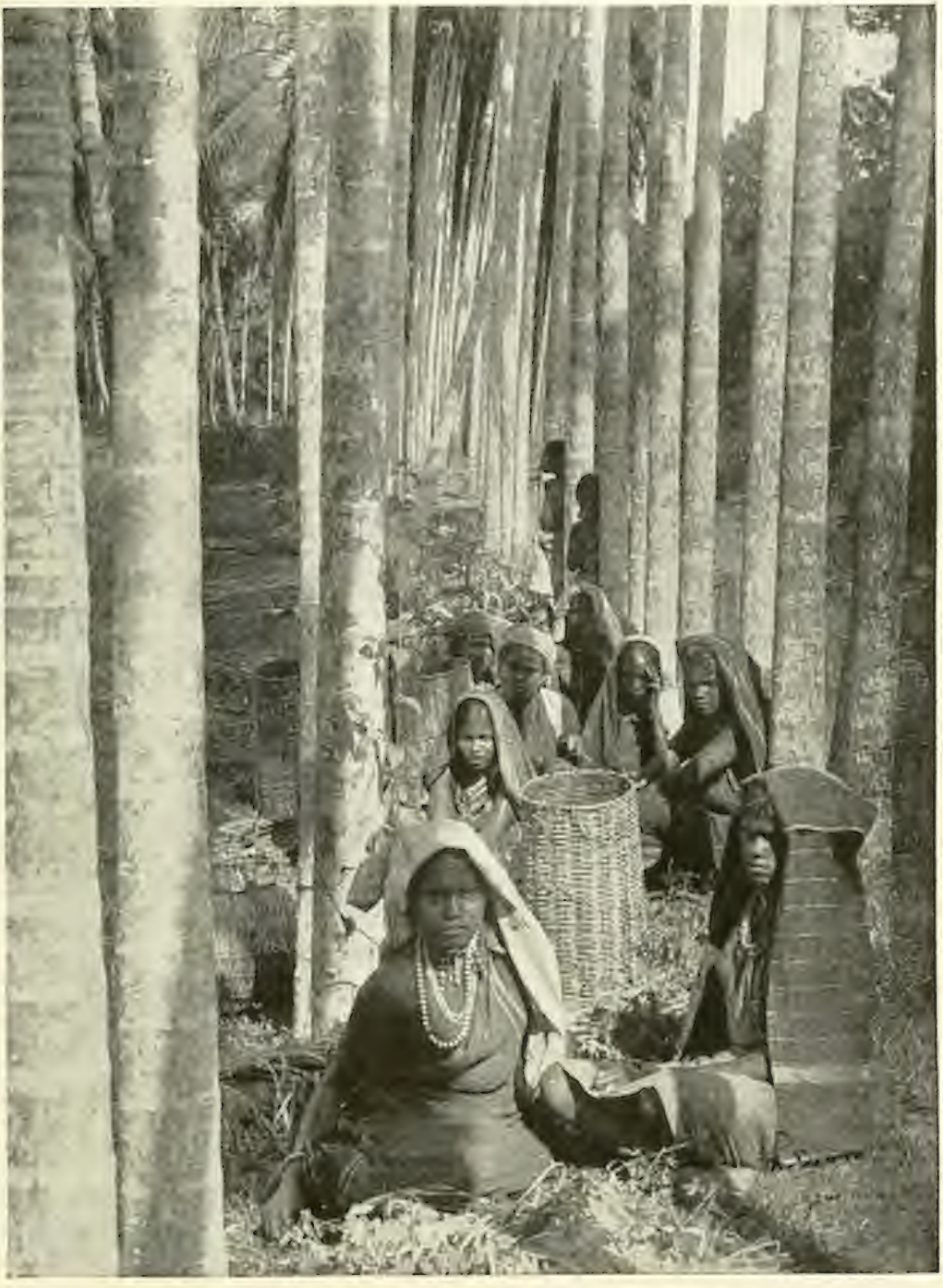


Photo and Copyright by Underwood & Underwood

RESTING AT MIDDAY ON A TEA PLANTATION

PAYING OFF THE PICKERS: CEYLON

"The average pay of 10 and 16 United States cents a day on the tea plantations is three times as much as they can earn in India; and, in addition, they are housed, given medical care, and schools provided for their children" (see page 147)

FERMENTING THE TEA

After the leaves are brought to the factory they are spread out on trays or racks for about 24 hours and allowed to wither. The leaves are then "rolled" (see page 169) in order to crush the leaves so as to liberate the juices. The leaves are then spread out in a cool house, as shown in this illustration, and allowed to ferment for several hours to make the "black" tea of commerce. If "green" tea is desired the leaves are not fermented. "Green" tea and "black" tea may come from the same tree: the difference is due entirely to the manner of treatment

PREPARING THE TEA BEFORE PACKING

After the leaves have fermented for several hours they are dried by hot air and then sifted into the various grades or qualities in which they are packed

SCENE IN A LARGE TEA-HOUSE: CEYLON

Most of the processes involved in tea culture may be seen in this room: on the right are the trays where the tea leaves are withered; on the left, big rollers in which the leaves are slightly crushed; on the floor the tea leaves may be seen fermenting, and in the background is the sifting and packing department. Some of the large tea estates have arrangements by which the tea is not handled after it has been picked.

Photo from Ellen R. Strickers

A LARGE TEA PLANTATION IN CEYLON

The British are the greatest tea drinkers, their average consumption being 6.17 pounds of tea for each person every year. Canada, Australia, and the people of New Zealand come next. A pound of tea is consumed by each person in Russia every year, while the per capita consumption in the United States is .89 pound. The French and Germans drink very little tea, the annual quantity used by each person in France and Germany being only .06 and .11 pound respectively. Most of the tea used in America comes from India and Ceylon, these countries exporting 240 million and 170 million pounds respectively. China exports about 188 million, Japan 39 million, and Formosa 29 million pounds per year.

Photo and Copyright by International Press Photo Co.

BAMBOO LADDERWAY IN GRAPHITE PIT: A CONTINUOUS STREAM OF MINERS CARRYING BASKETS OF PLUMBAGO: CEYLON

Graphite, which is one of the softest minerals, is found in veins several feet in thickness, sometimes possessing a columnar structure, perpendicular to the enclosing walls. Chemically graphite is identical with the diamond, but between the two there are wide differences in physical characters. Graphite is black and opaque, and the diamond, the hardest mineral known, is colorless and transparent.

Photo and Copyright by International Press Photo Co.

WOMEN HAND-CLEANING, SIFTING, AND BREAKING LARGE PIECES OF GRAPHITE AFTER SCREENING: CEYLON

The name graphite, from the Greek word meaning "to write," was originally given the mineral because it is used to such a large extent to make pencils. Many mines, in Ceylon and elsewhere, supply large quantities, but it is also produced artificially to a great extent. After being mined the ore has to be crushed and the graphite floated off in the water. In addition to pencils graphite is used in the manufacture of dry lubricants, grate polish, paints, crucibles, and for foundry facings.

mainland is a much smaller and simpler project than that of the one across the Florida keys, and it is inconceivable how it can be much longer delayed. Patronage is waiting, since 100,000 people in a season visit the great Dravidian temple of Rameswaram on Paumben, a shrine of the most elaborate kind, on the most stupendous scale—gateways a hundred feet high, corridors with carved columns and painted ceilings a thousand feet long, and other details in proportion.

THE PEARL FISHERIES OF CEYLON

By Hugh M. Smith

United States Deputy Commissioner of Fisheries

AS SOON as a traveler sets foot on the shores of Ceylon he comes under the subtle charm of the land, and is quickly imbued with the feeling that it would be most incongruous if such a climate did not produce the most luxuriant foliage, the most beautiful flowers, the most luscious fruits; if such a soil did not give forth the most wonderful profusion and variety of precious stones; if such surrounding waters did not yield the most resplendent pearls.

Ceylon has long been celebrated for its sapphires, rubies, cat's-eyes, moonstones, opals, amethysts, carbuncles, and emeralds; but none of these, nor all of them combined, have given to the island the fame and the romantic setting that have been conferred on it by the product of the limpid waters that bathe its coral strands and sandy beaches. The poetic name of Ceylon today is "The Pearl on India's Brow."

Colombo, the principal city of modern Ceylon, is a stopping place for all the steamers plying between Europe and Asia and Australia, and is therefore visited by thousands of tourists and travelers each year. But the pearl fishery is so remote from Colombo that not one visitor in ten thousand ever goes there.

In Colombo a person sees only a fraction of the great pearl crop, of which more than 90 per cent—99 per cent in some years—goes to India; but this fraction is sufficiently seductive to the transient visitor to render uncertain the time and manner of his arrival home, for the pearl shops in Colombo are veritable magnets that irresistibly attract the contents of purse and wallet.

FISHERIES 2,500 YEARS OLD

The pearl fishery of Ceylon and of India and the Persian Gulf is of very great antiquity, and is thought to be the oldest established fishery now in existence. The Sinhalese records, going back to about 550 B. C., indicate that the fisheries were then well developed, and there is reason to believe that they flourished at least 500 years before. At a very early period the pearls brought the island into prominence abroad, and were in great repute in Rome at the time of Pliny, who, referring to Ceylon under the name of Taprobane, wrote that it was "the most productive of pearls of all parts of the world."

From the most remote period of which there is any record, it would appear that the pearl fishery played a very important part in the history of Ceylon, having had more or less direct and intimate relations with every important aspect of the civilization of the island. The information available clearly suggests that from the earliest times the fishery was conducted in much the same way as in our own day—the same methods of obtaining the pearl oysters, of handling the catch on shore, and of extracting the pearls.

In the words of a local writer, "Ceylon is a place with a glorious past. Its once magnificent cities are now but a mass of crumbled and half-buried ruins; its native dynasty has passed away forever;

one institution alone has descended to us unchanged by the vicissitudes of 3,000 years—the pearl fishery."

In medieval times there was a very considerable literature of the Ceylon pearls and pearl fishery. In addition to frequent references in Arabic and Persian records of the eighth to eleventh centuries, the accounts of various European travelers (one of whom was Marco Polo, 1291) have come down to us and given glimpses that show how similar were the conditions then and now. The modern history of the pearl fishery, especially under British rule, has been most elaborately recorded.

THE PEARL OYSTER

It is hardly necessary to state that the pearl oyster of Ceylon, like the pearl oysters of other lands, is not an oyster at all. It is more nearly related to the mussels than to the oysters, and it differs markedly from the latter in having a byssus, or a bundle of tough fibers, by which it attaches itself to the bottom.

There are pearl oysters and pearl oysters. There are the huge thick-shelled species of the South Seas, Australia, Philippines, and Burma, that are as large as dinner plates and weigh 3 to 4 pounds as they come from the water; there are the small, thin-shelled forms of Venezuela, Japan, Persia, and Ceylon, that are only a few inches in diameter and weigh only a few ounces.

The large pearl oysters produce the mother-of-pearl of commerce, which is so valuable that the fishery is profitable even when no pearls are obtained. The smaller mollusks have little value except for the pearls they yield.

The maximum size attained by the Ceylon pearl oyster is only 4 inches, and the shells are so thin that they may be crushed between the fingers of an average man.

THE PEARL-OYSTER GROUNDS

Pearl oysters are found on all parts of the coast of Ceylon, but exist in sufficient abundance to support an important fishery only in the Gulf of Manaar, which is a large indentation between Ceylon and India, lying immediately south of the line of giant stepping-stones known as Adam's Bridge.

The pearl oysters are more or less concentrated on banks, which occupy a shallow, level plateau, extending from the shore for a distance of 3 miles in the southern section to 20 miles in the northern and broadest part of the gulf. This plateau is bounded by the 10 or 12 fathom curve, and falls away quite abruptly, so that within a very short distance of the fishing grounds we may get soundings of 100 fathoms, or even 1,000 fathoms. The area of the pearling grounds is about 800 square miles. The bottom is for the most part sand, diversified by outcroppings of calcareous rocks, which form flat or slightly inclined ledges, on which the pearl oysters grow. Aggregations of ledges constitute "paars," or banks, which centuries ago received names that are still applied.

The largest and most important of these grounds is Cheval Paar, lying from 9 to 13 miles offshore at a depth of 5 to 8½ fathoms, and extending about 6½ miles from north to south and 4½ miles from east to west.

UNCERTAINTY OF THE PEARL-OYSTER SUPPLY

Probably the most remarkable feature of the Ceylon pearl fisheries is the extreme uncertainty of the supply of pearl-bearing oysters, so that from early times, and doubtless from the very beginning, the fisheries have been most unreliable and intermittent. A Dutch official, writing in 1697, remarked that "the pearl fishery is an extraordinary source of revenue on which no reliance can be placed," and a British official in 1900 said: "This statement holds good after a lapse of more than two centuries. Indeed, the periodical disappearance of oysters from certain of the banks, sometimes for many years at a time, may be said to form one of the peculiar characteristics of the Ceylon fishery."

It is a matter of record that during the 19th century there were only 36 years when fishing was possible. Mentioning only the longer periods of cessation, it may be noted that there were no fisheries in the years 1821 to 1828, in 1838 to

1854, in 1864 to 1873, and in 1892 to 1900.

It was this last long series of recurring failures that induced the Ceylon government to secure the services of an eminent English biologist for a comprehensive investigation of the pearl-oyster grounds and of the causes for the disastrous failures. The result was that a great deal was made known concerning the conditions of life of the pearl oyster, and for the first time information was afforded the government by which the industry might be placed on a stable basis. Forthwith, in spite of a vigorous protest, the government leased the pearl fishery to a private syndicate and retired from the business from which it had been obtaining a large but not steady income.

WONDERFUL PRODUCTIVENESS OF THE PEARL OYSTER

As we study the life of the Ceylon pearl oyster, two points of transcendent importance are disclosed: (1) The mollusk is prolific to an incalculable degree, and (2) it is subject to an overwhelming mortality, which at times completely nullifies its productiveness.

The numbers of oysters produced are absolutely beyond comprehension. A few years ago, on one paar five miles long and two miles wide, small pearl oysters were ascertained to be present to the number of 10,000 per square yard, in places forming a layer over the bottom nine inches deep; one diver, who was down only 30 seconds, brought up 3,225 young oysters by actual count. This condition of the grounds was determined in November by government inspectors; in December of the same year no oysters whatever were found—all had disappeared as if by magic. On another bank, known as the Periya Paar, scientific experts in the year 1902 estimated the number of young oysters at one hundred thousand million, but so insecure was their existence that on inspection a few months later it was found that all had been swept away.

This destruction is due to a variety of causes, but principally to two: physical agencies, such as the burying of the oysters by sand, which are ordinarily responsible for only 4 to 5 per cent of the mortality; and animals, particularly fishes, of which various kinds and sizes feed largely on the pearl oysters, and are so charged with fully 90 per cent of all the losses to which the young and full-grown mollusks are subject.

Trigger-fishes, sting-rays, and other species with powerful jaws and strong digestive powers frequent the pearling grounds in hordes and find the pearl oysters entirely to their liking. Suggestions for protecting the grounds from the ravages of fishes have been made at different times. No practicable remedy has been offered, however; and, even if there were, there might be a potent reason for not applying it in the fact that this destruction of oysters by fishes is a step—and an essential one—in the formation of pearls.

ADMINISTRATION OF THE PEARL FISHERIES

Up to a few years ago, and for more than a century before, the British officials in Ceylon had absolute control of the fishery, and determined when a fishery should occur and what grounds should be opened to the divers. This determination was based on an examination of the various grounds in the November preceding a fishery, and a preparatory inspection of the particular grounds selected in the following February.

The preliminary inspection of the oyster beds on which it is proposed to permit the divers to work is for the purpose (1) of ascertaining the approximate number of pearl oysters that may be taken, (2) of marking the areas on which fishing is to be allowed, (3) of specifying the number of boats on each area and the number of days that are to be devoted to the fishery, and (4) of making an official valuation of the prospective pearls in order that the fishery may be advertised.

The official examination of the oyster grounds immediately before a fishery is one of the most interesting features of this great industry. The inspector anchors his boat in the center of what is regarded as a typical area, and is attended by four smaller boats each containing three divers. These boats are

rowed in concentric circles about the central vessel, and at intervals the divers are sent down with instructions to bring up every mature oyster they can collect in each dive. This work continues until 12 circles—the outer 1½ miles in diameter—have been run about the anchored boat and about 325 sample lots of oysters brought up.

The area covered by oysters being computed in square yards, the approximate number of oysters thereon is estimated by taking the average number of oysters per dive in conjunction with the average amount of bottom a diver is adjudged to clear at one descent (2½ to 3 square yards). The government estimates based on this method are sometimes remarkably close. Thus, in 1904, the prospective yield of the fishery was announced as 35 million oysters, and as a matter of fact 37 million were gathered.

In conjunction with the determination of the approximate number of fishable oysters on the beds, 25,000 to 30,000 oysters from various grounds are opened and their pearls extracted, sorted, and appraised under government auspices, the valuation being entrusted to disinterested pearl merchants. A rough basis is thus afforded for estimating the average worth of the pearl oysters per 1,000, and this information is published broadcast by the government in the circular announcing the fishery.

The pearl content of the oysters varies from year to year and on different parts of the same ground, owing to several factors; and the advance estimate of the government has the praiseworthy object, if it does not have the effect, of keeping the speculative fever within reasonable limits. It has sometimes happened that notwithstanding the formal assurance of the government that the grounds to be opened for fishing will probably yield pearls of the value of, say, 20 rupees per 1,000 oysters, the pearl merchants have run the prices up to 40, 60, 80, or more rupees.

MARICHCHUKADDI, THE PEARL TOWN

News that a fishery is to be held travels as by wireless telegraphy throughout Ceylon, India, and other parts of the East, and at the prescribed time 30,000 to 50,000 people gather in a few days on a strip of desert sand, with the Persian Gulf on one side and the jungle on the other, at a point convenient to the pearl-oyster grounds. A town covering a square mile springs up like a boom town in the West, with regular streets, private houses, shops, markets, banks, a cemetery, and government buildings, such as a court-house, post and telegraph offices, prison, and hospital. In the outskirts of the town large water-tanks are constructed to supply water for washing clothes and for bathing; there are also wells or cisterns throughout the town. As there is no harbor, the fishing boats draw up in a long line on the beach.

A more heterogeneous aggregation of humanity could hardly be found elsewhere. Besides the British officials, with their assistants and servants and the force of 200 native police, there are the multitudes of fishermen, merchants, mechanics, pawnbrokers, money-lenders, priests, coolies, and pearl buyers and speculators, of every conceivable color, speaking a score of tongues, and representing half a dozen religions. To amuse, divert, and prey on those who have legitimate business in the pearl town, there are fakirs, jugglers, dancers, beggars, gamblers, and loose characters of both sexes, providing every allurement that will appeal to the sons of Buddha, Brahma, and Mohammed.

The chief of police wrote of the pearl town in 1905: "There were 40,000 to 50,000 persons, of whom it may be said that not less than a tenth were gamblers, vagrants, and rogues, who, without occupation in their own country, made their way to Marichchukaddi with the hope of making money to gamble in oysters."

Here we may study under very favorable conditions the distinctive personal habits and customs of nearly every littoral race from the Yellow Sea to the Mediterranean. Here are thousands of the most attractive members of the Ceylon population—the Sinhalese or Ceylonese proper—varying in color from light to dark bronze, with their slender, graceful forms and finely cut features; here are the black Tamils, most unat-

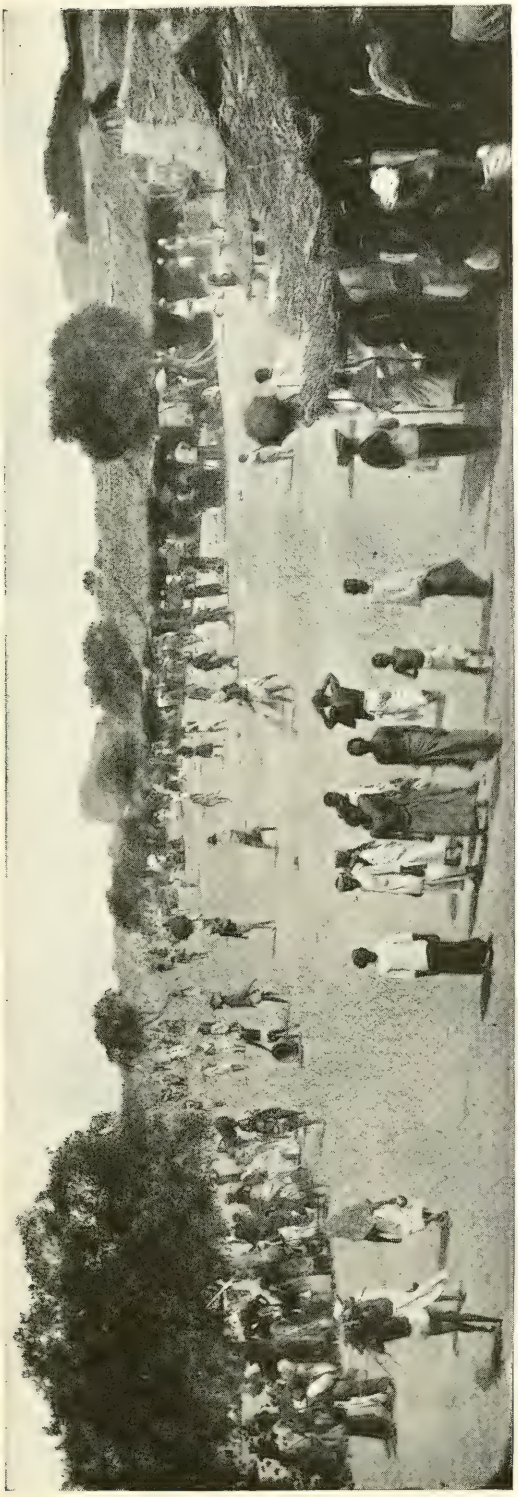


Photo by Andreé

MAIN STREET IN MARICHCHUKADDI, THE PEARL TOWN OF 50,000 PEOPLE, WHICH SPRINGS UP IN A FEW DAYS (SEE P. 176)

tractive and unfortunate victims of their religion and caste; here are Kandyans from the hill country and outcast Veddahs; here are native-born Dutch, Portuguese, and half-breeds, all mingling with Arabs, Chinese, and the scum and riff-raff of the mainland of Asia.

It can readily be understood that the pearl town is a place of intense activity from the moment the government agent opens the fishery. The extensive business connected with the mere existence of the people would alone be sufficient to give great bustle and life; but added to this are the special industries dependent on the various phases of the pearl fishery.

As soon as the fishery is over, the entire place seems to dissolve in a day as if by magic, the people hurry to their homes, the pearl town lapses again into a solitary sandy waste, and the beasts of the jungle take possession. Marichchukaddi may spring into being the next season, but may remain non-existent for many years.

THE DIVERS, THEIR BOATS AND METHODS

Four distinct racial types are represented among the divers who are attracted to the pearl town when a fishery is announced, and all of these and several others congregate on shore to supply the needs of the vessel crews. There are Tamils, most of whom come from the coast of the Madras presidency; Moormen, who are chiefly drafted from villages on the Madura coast of the same state; Malays from the southern part of the Malabar coast, and Arabs, mostly recruited from Colombo and Jaffna. The Tamils and the Moormen are the most numerous, usually representing about four-fifths of the total number; the Arabs are the least numerous, but are the most proficient as fishermen.

There is no particular style of

Photo by Andreé

THE PEARL FLEET PREPARING TO START FOR THE PEARL GROUNDS

"There is no particular style of vessel specially required in the pearl fishery, and consequently we find a great diversity of rigs, depending largely on the regions from which the divers come: narrow single-masted canoes with an outrigger square-sterned luggers, large sailing lighters, three-masted canoes, and clumsy doneys. Some of the larger vessels carry 65 men, of whom about half are actual divers, and the average crew of the entire fleet is 30 to 35 men" (see pages 177 and 179).

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Owing to the boisterous seas and strong winds of this region, the fishery can be conducted only during a period of a few weeks in March and April, when the northeast monsoon has waned and the southwest monsoon has not begun. The fishery is thus of briefer duration than any other pearl fishery of importance, and is characterized by a strenuousness that is quite foreign to the East.

The fishing boats start for the grounds soon after midnight, so as to be ready for work as soon as daylight comes, about 6 a. m. They take positions about the government vessel moored over the particular ground selected, anchor, and remain actively engaged until noon, when the entire fleet sets sail and starts for the shore. As there is a crowd of pearl merchants eagerly awaiting an opportunity to speculate, there is considerable rivalry among the diving boats in the matter of reaching land and discharging their catch as soon as possible, and consequently one witnesses some wild scenes of excitement when the oysters are being unloaded in the surf and the natives are rushing into the kottus with their catch.

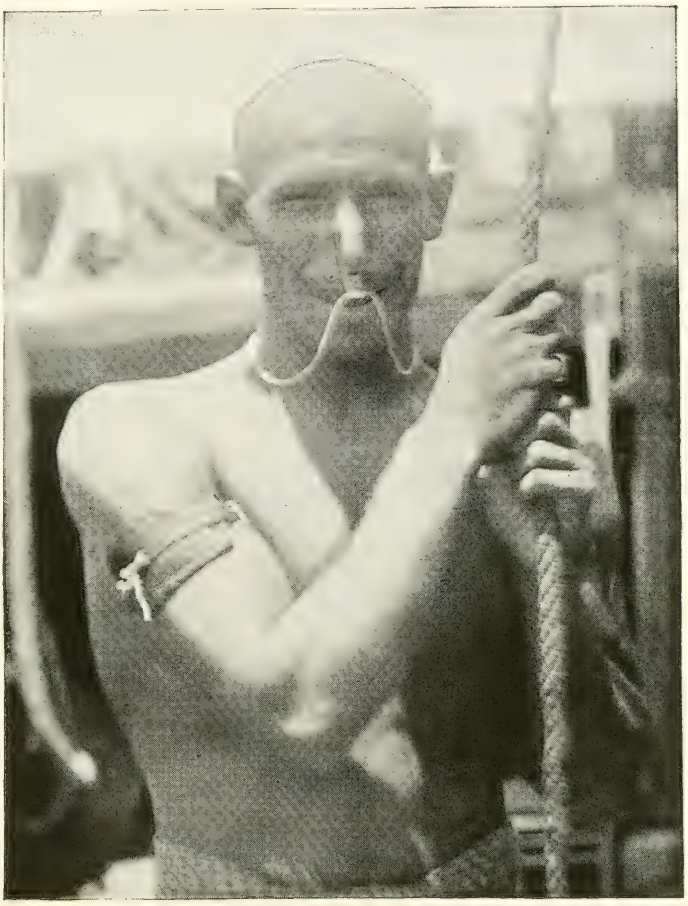

Photo from Dr. Hugh M. Smith

AN ARAB DIVER FROM THE PERSIAN GULF, WITH NOSE-CLIP

"A great deal of sentiment has been expended on the pearl-divers and the dangers they have to undergo, particularly from rapacious man-eating sharks. The writers of both poetry and fiction for centuries have played on the feelings of humanity in depicting the perilous life of the divers. As a matter of fact, there is no particular risk or hardship encountered by the Ceylon divers. Year after year, among the 3,000 to 9,000 divers engaged, not a single fatal or serious accident may occur" (see page 183).

Except for a loin cloth, the divers are naked. Their fingers are covered by flexible leather shields to protect them from the rough corals and shells. In order to facilitate the descent, each diver employs a flat, oval stone, weighing 30 to 50 pounds. The stone is perforated at one end to receive a rope, and close to the stone a kind of stirrup is made in the

Photo by Andreé

ARAB PEARL-DIVERS AT WORK: EACH DIVER HAS A "MANDUCK," OR HELPER, TO WATCH AND HELP HIM IN AND OUT OF THE WATER (SEE PAGE 182)

"The descents occur at intervals of 5 or 6 minutes. The best divers are careful to dry their bodies thoroughly after each descent and to take sufficient rest. Between dives they often smoke a pipe or cigarette, sometimes while in the water just preparatory to a dive."

Photo by Dr. Hugh M. Smith

THE PEARLERS LOOK MORE LIKE PIRATICAL CREWS ABOUT TO BOARD A CAPTURED PRIZE THAN PEACEFUL LABORERS IN A WATERY VINEYARD

"On what is regarded as good ground, the average per man per dive is 25 to 35 oysters, but it sometimes rises to 75 or drops to 5 or nothing at the end of a fishery. On one day in 1904 twelve boats, manned exclusively by Arabs, fishing from dawn till noon had an average catch per boat of 22,811 oysters" (see page 182).

rope to accommodate the diver's foot. The stone is suspended at a depth of 4 to 5 feet below the surface by means of a cord attached to an outrigger.

When ready to descend, the diver places one foot on the stone, the other on the rim of a rope basket attached to a rope, inflates his lungs, loosens the slip-knot holding the stone, and sinks rapidly to the bottom. There he at once disengages his foot and quickly crawls over the bottom, tearing loose all the oysters he can reach and putting them in the basket. When near the limit of his endurance, he gives a signal with the basket rope and is quickly hauled up by the watchful attendant, or "manduck," with whom the diver is provided. The helper has meanwhile pulled up and secured the diving stone, and when the basket is hauled in he culls the catch from the miscellaneous refuse that is attached to the oysters.

HOW LONG CAN A DIVER REMAIN UNDER WATER?

The divers usually operate in pairs, with a common attendant and diving stone. The descents occur at intervals of 5 or 6 minutes. The best divers are careful to dry their bodies thoroughly after each descent and to take sufficient rest. Between dives they often smoke a pipe or cigarette, sometimes while in the water just preparatory to a dive.

The divers have learned by experience that they may increase the length of their submergence by making a number of deep, forced respiratory efforts before taking the plunge. Most exaggerated stories have been told and are still current regarding the length of time the divers can remain under water.

The Arab divers wear nose-clasps of flexible horn attached to a cord around their neck, while the divers of other races simply compress their nostrils by hand during the descent. This practice can hardly make any difference in efficiency, and we must conclude that the expertness of the Arabs depends on an aptitude born of long experience.

Their usual time below the surface is 60 to 75 seconds, the normal maximum not exceeding 90 seconds, while the Tamil and Moormen divers range from 35 to 50 or 60 seconds, depending on the depth. There is a well authenticated case in 1887 of an Arab who remained under for 109 seconds in water 7 fathoms deep.

The most curious feature of many of the ancient and some of the modern accounts of the pearl fishery is the remarkable ability to remain under water ascribed to the Arabs and others, and it is noteworthy that this ability increases with the remoteness of the time. Percival, whose "Account of the Island of Ceylon" was published in London in 1803, said the usual time for the divers to remain submerged "does not much exceed two minutes, yet there are instances known of divers who could remain four or even five minutes. . . . The longest instance ever known was of a diver who came from Anjango in 1797, and who absolutely remained under water full six minutes."

Le Beck, in his "Asiatic Researches," London, 1798, reports that he saw a diver remain down for seven minutes. Sir Philiberto Vernatti reported to the Royal Society of London in 1667, in response to a special inquiry of the society, that "the greatest length of time that pearl-divers in these parts [Ceylon] can continue under water is about a quarter of an hour."

The Dutch anatomist Diemerbroeck, in his "Anatomy of the Human Body" (1672), cites the case of a diver who, under his own observation, used to work under water for half an hour at a time; and Batuta, another man of science, writing of pearl-divers in 1336, said that "some remain down an hour, others two hours, others less."

The number of oysters taken at each dive necessarily varies greatly, depending on the diver, the depth, and the density of the growth. On what is regarded as good ground, the average per man per dive is 25 to 35; but it sometimes rises to 75 or drops to 5 or nothing at the end of a fishery. On one day in 1904 twelve boats manned exclusively by Arabs fishing from dawn till noon had an average catch per boat of 22,811 oysters. Usually the men do not like to work on grounds that yield less than 15

Photo by Andreé

THE FIRST TO LEAVE THE BANKS AFTER THE MORNING'S DIVE

or 20 oysters per dive, so the grounds are rarely stripped clean, so far as human agency goes.

A great deal of sentiment has been expended on the pearl-divers and the dangers they have to undergo, particularly from rapacious man-eating sharks. The writers of both poetry and fiction for centuries have played on the feelings of humanity in depicting the perilous life of the divers. As a matter of fact, there is no particular risk or hardship encountered by the Ceylon divers.

Year after year, among the 3,000 to 9,000 divers engaged, not a single fatal or serious accident may occur. An Englishman, who spent a number of years on the fishing grounds during the entire season, never had a glimpse of a single shark dangerous to man. An English official, who had a life-long experience in the Ceylon pearl fisheries, never knew of a single diver being killed by a shark, and heard of only one case and that extremely doubtful. Still another Englishman, writing in 1887, stated that it was "pretty certain that in the whole course of the Ceylon fisheries only two human beings have fallen victims to these fierce fishes" (see also page 190).

ILLICIT TAKING OF PEARLS

On the trip from the fishing grounds to the shore the divers and manducks have two to four hours of undisturbed leisure in which they improve the opportunity to open oysters and extract and conceal any pearls they may find. This practice

Photo by Andreé

THE FLEET RETURNING FROM THE PEARLING GROUNDS

"On the trip from the fishing grounds to the shore the divers and manducks have two to four hours of undisturbed leisure, in which they improve the opportunity to open oysters and extract and conceal any pearls they may find. This practice is illicit and in violation of the fishery regulations, but it is very difficult to suppress. Guards have sometimes been employed on each vessel, but as they are the friends of the divers and receive only 33 cents a day for their services, there is every reason to believe that they require no large inducement not only to countenance, but actually to encourage, this fraudulent work."

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The government estimates that at times fully 25 per cent of the catch is illicitly opened; and, as the largest and most productive oysters are thus weeded out, the government losses in revenue have been considerable. It was computed that in 1905 not less than 15 million oysters were opened by the divers on the homeward trips. These, at the average selling price for the season, were worth $250,000 regardless of the contained pearls. The men resort to all kinds of expedients for concealing the pearls in order to avoid detection by the shore officials before whom they have to pass.

DIVISION OF THE SPOILS

Under the arrangement that has prevailed for many years, the divers are allowed to retain one-third of their catch, to dispose of as they please. The government retains the remainder and sells it at auction.

The most important structures in the pearl town are the palisaded enclosures, known as the kottus, in which all of the pearl oysters are deposited and retained until disposed of. The fences are made of bamboo poles, and within the enclosures are bamboo sheds with thatched roofs of palm leaves.

When the boats reach shore the oysters are quickly unloaded and taken at once to the near-by government kottus, where the catch of each boat is put in a separate compartment. The divers count their catch into three piles containing the same number of oysters, and the government agent then selects the pile that shall go to the crew.

The divers then emerge from the other (land) side of the kottus carrying their precious oysters, and are at once surrounded by a crowd of natives desirous of obtaining oysters in small quantities. The trade conducted by the divers is of a strictly retail nature, and it sometimes happens that a native—man, woman, or child—will buy on speculation a dozen or half a dozen oysters, or even a single one. The stock of the divers is usually eagerly sought and quickly bought.

After disposing of their catch the divers spend the remainder of the day in eating, resting, bathing, and religious devotions.

The government's share is carefully counted by clerks, and about sunset each day is put up and sold at auction at the court-house by the government agent. The unit of measure is a thousand, and a successful bidder may take one or many thousand at the price offered. During the night the oysters are carefully guarded, and next morning the buyers present their certificates of purchase, pay the price, and take their goods.

ROTTING THE OYSTERS

It is a very difficult matter to extract the pearls from perfectly fresh oysters either by sight or by touch, or by both combined; consequently it has long been the practice to allow the decomposition of the soft parts before the search for the pearls is begun. The rotting process is exceedingly repulsive, and if the wearers of beautiful pearl jewelry realized the unspeakably filthy mass from which their gems had come, some of the more esthetic would shudder every time they beheld them.

The oysters are piled into dugout canoes and covered with matting or else set aside in coarse sacks for 7 to 10 days. Bacterial putrefaction is supplemented by the work of blow-flies and their larvæ, and at the end of the period stated the disintegration, decomposition, and digestion of the oysters have progressed so far that there is little left but pearls, shells, slime, and foreign matter adhering to the shells, together with a large volume of maggots. The first step in the cleansing process is the flooding of the canoe to the brim; then the naked natives, ranged on either side of the vessel, remove the shells, washing and rinsing them and removing any detritus in which a pearl may lodge.

hoto by Andreé

THE PEARL OYSTERS BEING CARRIED FROM THE BOATS INTO THE GOVERNMENT KOTTUS TO BE COUNTED AND APPORTIONED

(SEE PAGE 185)

Eternal vigilance must be exercised by the owners to prevent the theft of pearls, and one of the precautions taken is to forbid the washers to remove their hands from the water except to drop at their feet the cleansed shells.

The shells having been removed, the canoe is filled with water again and again, and the gurry is kneaded and stirred in order that the lighter filth may be floated off. The water is finally decanted, and the heavier débris containing the pearls is removed with scrupulous care and wrapped in cotton cloth, undergoing a preliminary search for the largest pearls and numerous subsequent examinations in the course of drying.

The dried matter is then sifted and sorted and gone over again and again; and then, when it would appear that even the dust pearls must all have been extracted, the débris passes for a final search into the hands of women and children, whose sharp eyes and delicate touch enable them to discover an amazingly large quantity of small pearls. The material then remaining is offered for sale and always finds ready buyers.

We can easily imagine the anxiety of the speculators, especially the small plungers, when the washing of their pearl oysters has begun, and we can readily understand the nervous tension under which they exercise the right to thrust their hands into the gurry and pick out the pearls. Having the scantiest clothing, or none at all, whenever they withdraw pearls from the mass of putrid matter and squirming maggots they may deposit them in the safest and most available receptacle—their mouth!

THE GREATEST FISHERY ON RECORD

The most productive fishery in the recorded history of Ceylon was held in 1905. Three hundred and eighteen vessels participated, and during the season that extended from February 20 to April 21 over 81,000,000 pearl oysters were landed, whereas the best previous fishery, in 1891, yielded only 44,000,000. On a number of days over 4,000,000 oysters were obtained, and one day, when 5,005,000 were taken, a record was established that may never again be equalled.

The preliminary government inspection of the oysters on the grounds set apart for the fishery showed pearls present of the average value of about 23 rupees ($7.70) per thousand; but at the beginning of the fishery there was a marked enhancement in the value of pearls in the world's great markets, and the value increased during the progress of the fishery, so that the speculative prices for the oysters at times soared to $30 and even $40 per thousand, and the average price for the season was $16 to $17, making the first yield of the fishery about $1,365,000, excluding the value of oysters stolen by the natives while on the boats. The prices of pearls in Bombay and Paris warranted the prices paid in Ceylon for the oysters, and the merchants who sold their holdings made large profits.

RECENT HISTORY OF THE FISHERY

The continuation of the high prices for pearls and the large profits of the 1905 fishery resulted in unusual interest in the season of 1906; the 473 vessels that reported for employment carried 8,600 divers, of whom about 4,100 were Arabs, a much larger number of this race than had participated in this industry in recent times. There was a large catch, and the oysters were purchased at abnormal rates. In the subsequent year also prices ranged high.

In 1906 a record was established, when on one day 309 rupees (over $100) per 1,000 oysters were paid, and in 1907, when the speculation fever attained unusual severity, 70 to 90 rupees were not infrequently bid for oysters that ordinarily would bring only 15 rupees, and the verdict for the season was that the contained pearls did not warrant the prices paid. Then came the financial panic. The demand for pearls in Paris, London, and New York fell off, prices dropped, and the Bombay merchants lost heavily, and several of the leaders committed suicide in consequence.

It is a rather interesting fact that since the government leased the pearling rights to a private syndicate in 1906 there has been no fishery worth mentioning. Notwithstanding this, however,

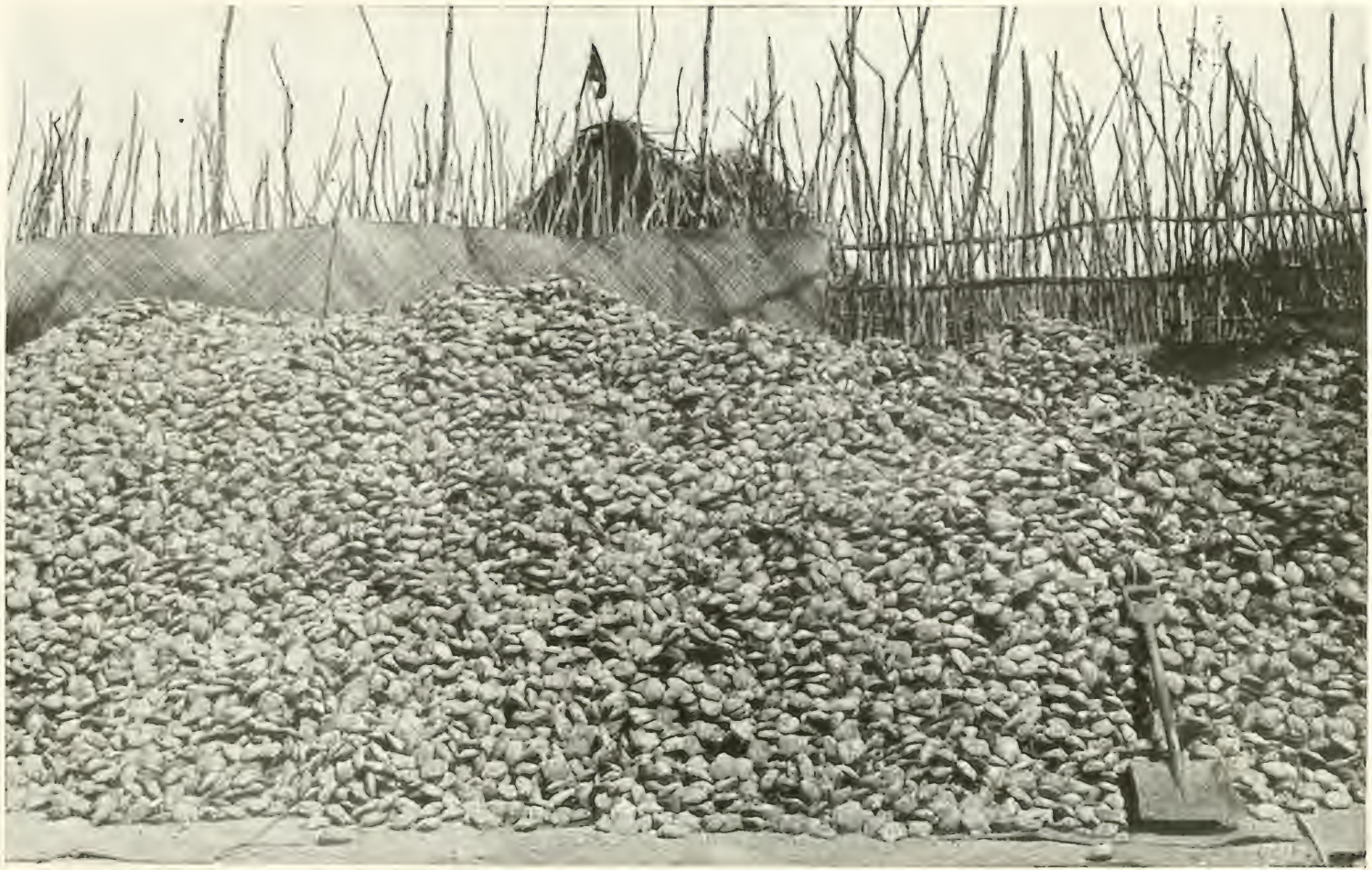


Photo by Andreé

THE BEST[a] PART OF A MILLION PEARL OYSTERS

The stench from these rotting oysters is appalling, and few Europeans can stand it. The natives, however, seem to mind it not at all

Photo by Andreé

THE DIVERS RECEIVING THEIR WAGES IN OYSTERS: THEY FREQUENTLY FIND VERY VALUABLE PEARLS IN THEIR SHARE AND ARE MADE RICH FOR LIFE

the company, having received the government's proceeds of the fishery during the last year under the old régime, has been able to declare large dividends, and the stockholders have had reason to be well satisfied and can afford to wait awhile for another successful fishery.

Recent reports received from Ceylon were quite alarming as to the condition of the grounds. No spat had fallen; there were few adult and young oysters on the grounds, and no fishery was expected for several years.

THE FAKIRS

The pearl fishery is the Mecca of all sorts and conditions of fakirs from all over the East. There are snake-charmers, conjurers, astrologers, devil-dancers, and all the other oriental counterparts of the fakirs who frequent the county fairs in America, and there are fakirs directly connected with the pearl fishery.

The pearl fakirs sit about the streets at little three-legged wooden work-tables, and there drill pearls for stringing; buy and sell defective pearls; convert bad pearls into good ones, and palm off repaired, plugged, peeled, and doctored pearls on the unsuspecting and unsophisticated. Their principal livelihood is from the handling of blemished pearls.

Sometimes pearls will exhibit defects that greatly impair their market value; but there is always a possibility that the blemish may be only "skin deep," and that by peeling off the outer layer or layers of pearly matter the underlying part will be found to be free from defect.

On the other hand, pearls may have superficial defects that detract from their value, but are not sufficient to prevent sale at good prices and their use for special purposes; and such pearls, if peeled in the hope of entirely eliminating their defects, may be rendered worthless by the rapid increase in the size of the defect as the lower layers are uncovered.

One can readily see the elements of

Photo by Andreé

THE GOVERNMENT STOREHOUSES, OR KOTTUS, WHERE THE OYSTERS ARE SAFEGUARDED AND AUCTIONED OFF (PAGE 185)

uncertainty and the lottery possibilities that are here presented to professional fakirs and amateur speculators. To illustrate the uncertainties of pearl faking: I knew of a Tamil laborer who risked his savings of 150 rupees on a blemished pearl, which he forthwith proceeded to peel. The removal of each successive layer left the pearl with a larger visible defect, and when the futility of further peeling was impressed on the speculator he had on his hands a pearl that with difficulty was disposed of at 25 rupees.

A little later this same man, still possessed of the speculative fever, had an opportunity to buy for 75 or 100 rupees a pearl with a large discoloration, which possibly involved only the superficial layers. Not wishing to run the risk alone, he induced two others to enter the pool with him. The pearl, subjected to the skillful treatment of a fakir, was soon rid of its defect and ultimately sold for 900 rupees.

Notwithstanding the comparative safety of the diver's vocation, from a very remote period up to a recent date the ignorant and superstitious Indian divers insisted on the presence at each fishery of shark-charmers, whose function it was, for substantial considerations, to keep the sharks away from the individual divers, and who had the power to make sharks bite divers who did not exhibit a proper respect for the conjurers' powers. These impostors appear to have reached the height of their influence in the 13th century, when there was probably one on each diving boat and when their share amounted to fully five per cent of the aggregate take of oysters. Under the Portuguese it was deemed expedient to permit 12 of these fakirs to ply their trade, with diminished privileges and

Photo by Andreé

PEARL BUYERS: THESE MEN OF MANY RACES AND CREEDS ARE WONDERFULLY EXPERT IN RECOGNIZING AND APPRAISING PEARLS

income, and when the British acquired Ceylon the number was reduced to two, who at first were allowed to receive one oyster a day from each diver, but later were paid a regular salary by the British government and were forbidden to exact any tribute from the natives. Finally, after flourishing for at least 600 years, and possibly for 1,000 or more years, the shark-charmers were abolished just 25 years ago (see page 183).

THE PEARLS OF CEYLON

Pearls have always been regarded as especially appropriate for the ornamentation of royal personages, and the pearls of Ceylon, owing to the extraordinary numbers that have been produced and the active prosecution of the fishery for ages, have probably been more extensively worn by exalted individuals than have the gems of any other region. The pearls of Ceylon are probably found in the official or personal jewels of every female sovereign and in the crowns and regalia of most of the male rulers of today.

The most lavish use of pearls is met with among the Indian rajahs, some of whom, when clad in their full dress, are literally covered with these gems. These pearly possessions often represent the greatest item of wealth of these nabobs, and are usually heirlooms, added to from time to time and rarely disposed of, so that vast accumulations have sometimes occurred.

The pearls of the Ceylon waters are for the most part silvery white in color; sometimes they are yellowish, creamy, or pinkish. For luster, or "orient," they are surpassed by the pearls of no other

Photo by Andreé

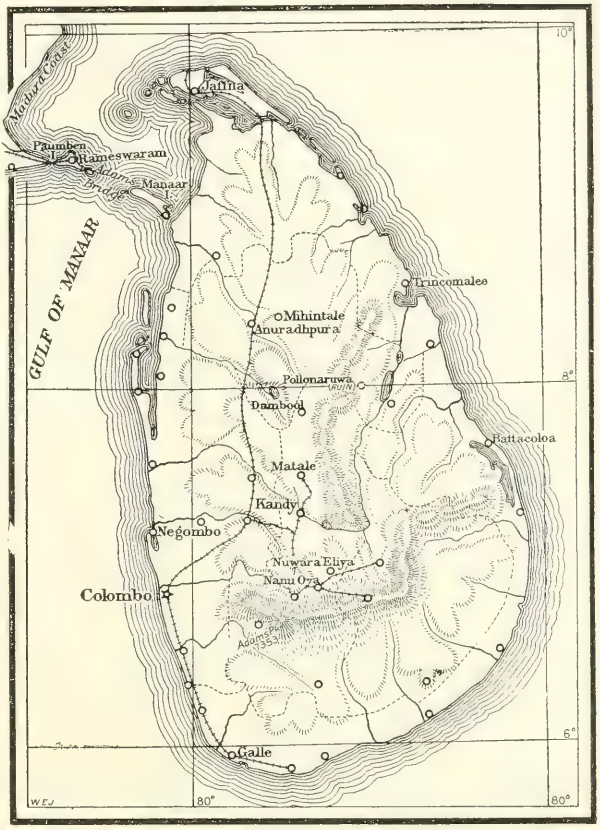
THE PEARL FAKIRS

These men earn a living by stringing, peeling, and repairing defective pearls. They are very skillful workmen, but frequently dishonest in their dealings (see pages 189 and 190)

part of the world, and for spherical regularity, also, they are unexcelled. Other peculiarities are that their size averages smaller than elsewhere in the world, and that their number exceeds that in any other fishery. Pearls weighing over 10 grains are very uncommon, and by far the larger number weigh less than two grains. Specimens worth $350 at the fishery are rare; the most valuable pearl found in 1904 sold locally for $830, and the record fishery of 1905 yielded one valued at $4,000.

More seed pearls result from the Ceylon fisheries than from all other parts of the world combined. The most minute, that have no value as pearls, are calcined and sold to the wealthy for chewing with the betel nut. The same use is made of many American fresh-water pearls, for which a market has now been established in Bombay.

Somewhat larger seed pearls, that have no sale outside of Ceylon and India, are placed in the mouths of deceased Hindus of means, replacing the rice grains that are employed for the same purpose by the poorer people.



OUTLINE MAP OF CEYLON (SEE PAGES 115, 135, 145, AND 153)

The larger seed pearls are drilled, strung, and used for ornament. The drilling is done by the most primitive means, and it is a very clever workman who can perforate 40 to 50 pearls in a day with the ancient bow-drill. This will enable us partly to estimate the labor required to drill the 120,000 seed pearls in a necklace, dating from the Louis XVI period, now the property of an American lady. By means of one of the modern mechanical drills, 1,500 pearls may be easily and accurately perforated in a day.

ORIGIN OF PEARLS

Pearls differ from other gems in the brief period of their existence in a natural state, and in the steady renewal of the supply. A diamond or a ruby, formed a hundred thousand or a million years ago, remains practically unchanged until found by man. A pearl, unless plucked when ripe, like a fruit, drops to the bottom and quickly loses its value when the creature that makes and harbors it perishes.

It is interesting to contemplate that in all waters having pearl-bearing mollusks, from the earliest dawn of history down to the present time, much the larger part of the pearl crop has never been harvested and never seen by man, but has been scattered on the floor of the ocean as the oysters have died in the course of nature. This is particularly striking in the case of the pearls of Ceylon because of the brief, almost ephemeral, life of the oysters.

It is not necessary in this article to enter into a discussion of the origin of pearls, but it is not inappropriate that

some brief mention thereof be made, because this subject has received special elucidation in Ceylon.

During the first 1,500 years of the present era, and doubtless for many preceding centuries, every theory of pearl formation had as its essential feature the idea that every pearl was originally a drop of dew or rain—possibly a tear—that gained entrance into the shell of an oyster in one of various ways. Pliny the Younger, in his celebrated Natural History, gives a detailed description of this process, and similar accounts appear in the writings of philosophers, travelers, poets, and others in ancient, medieval, and even early modern times.

It is a noteworthy fact that at the present time the Arab, Persian, and Indian divers quite generally believe that at certain seasons the pearl oysters come to the surface in the morning, open their shells, and suck in or imbibe in some way a dewdrop or raindrop, which, suffused with sunlight, is slowly transformed into a lustrous pearl. The American consul at Aden recently reported that the scarcity of pearls in the Red Sea was ascribed by the Arabs to the fact that little rain had fallen for several years.

We now know that almost any kind of foreign body—whether a grain of sand, a bit of mud or shell, a piece of seaweed, or a small animal—may by its irritation cause the mollusk to cover it with nacre and make it the nucleus of a pearl. The pearly matter is slowly deposited in definite layers, and the growth of the pearl continues indefinitely.

But if the annual supply of pearls depended on the foreign bodies accidentally gaining entrance into the cavity of the pearl oyster, there would be no great pearl fisheries, and pearls would not be the highly prized, costly gems they are.

It has now been pretty definitely established that the great bulk of the annual pearl crop of the world—probably 90 per cent of it—represents animal parasites which normally pass a part of their life-cycle within the pearl oysters, and during that period, becoming encapsuled in the tissues of the mollusk, are in time covered with a nacreous coat, owing to the irritation they impart to the oyster. It was not until the middle of the 19th century, however, that the parasitic origin of pearls was proposed and established, and some of the earliest research was addressed to the Ceylon pearl oyster. But it was only during the present century that the true rôle of the parasite and its life history were satisfactorily cleared up.

It is now known that the minute spherical larvæ of various marine worms, but particularly of cestodes, enter the pearl oysters and become more or less embedded in the soft tissues, as many as 40 of these larval worms having been found in one Ceylon pearl oyster. As a result of the irritation caused by a larva, the oyster forms a protecting epithelial sac about the intruder, and then, if the latter dies, its mass is gradually converted into carbonate of lime, pearly nacre is secreted by the contiguous epithelium, and the growth of the pearly mass proceeds with the growth of the shell which is formed in the same way.

Reference has been made to the life-cycle of the parasite. If the larvæ do not die, the hosts may be eaten by fishes and the larvæ will not find lodgment therein and undergo a certain development. Among the fishes that largely prey on the pearl oysters are the tough-skinned, strong-jawed trigger-fishes. These in turn are eaten by large rays that are common on the pearl-oyster grounds, and in the rays the worms reach their full development and produce young (larvæ) that are cast into the water and find lodgment in the oysters.

We are thus prepared to accept the well-known saying of a celebrated French investigator, that "the most beautiful pearl is in reality only the brilliant sarcophagus of a worm."

THE PANAMA CANAL

By William Joseph Showalter

WHEN the British Ambassador, Mr. Bryce, at the recent annual dinner of the National Geographic Society, stated that the American people are carrying to a successful conclusion the greatest engineering achievement of history or of prospect, he spoke in terms of truth and not of poetic license. That it is being carried to a successful conclusion appears when it is related how near to completion the big waterway is; that it will live through all the ages as the greatest single monument to human energy seems evident when the magnitude of the task is put into comprehensible terms.

An excellent idea of the magnitude of the work will appear from a statement of what has been accomplished in the five years of Col. George W. Goethals' directorship of the work, which ends in April. By that time the material removed under his direction will have amounted to the enormous total of 160 million cubic yards. If all this material could be placed in a solid shaft of the shape of the Washington Monument, with a base as large as an average city block, it would tower more than six miles skyward, overtopping the earth's loftiest mountain peak by more than a mile. Again, if it were to be loaded onto the big lidgerwood dirt cars used on the canal, it would make a string of them reaching over two and a half times around the earth and requiring a string of engines reaching from New York to San Francisco to move them. And yet this will be increased by more than one-fifth before the last carload of spoil is hauled away.

No less impressive is the story of the magnificent manner in which the work is being carried forward. When Congress asked for information as to the number of yards of material to be removed and the length of time it would take to remove it, the engineers, in a report characterized by optimism rather than pessimism, declared there were 103 million cubic yards of material to be removed, and that it would take nine years to do it. Since then enlargements in the bottom width of Culebra Cut, slides, and other conditions have forced the total amount of material to be excavated up to 195 million cubic yards. Under those original estimates it would take 17 years to complete the work. Yet the canal army, under the leadership of Colonel Goethals, will complete it in a little more than six years of actual, full-swing work.

In other words, the amount of material to be removed has been increased by about 90 per cent, while the time of removal has been cut down about 30 per cent.

In 1908 it was estimated that the total amount of material to be removed, as the project was then laid out, would amount to 135 million cubic yards, and that the total cost of the completed canal would be 375 million dollars. Since that time 60 million yards more have been added to the total excavations, and yet the prospect is that enough money will be left on this estimate, as a result of unexampled efficiency and economy, to build a new breakwater and perhaps to make a giant new storage reservoir at Alleluja.

Under what difficulties all of this has been done the world never will fully understand. Think of a farm of 147 acres slipping foot by foot into the canal, and yet being taken out as a mere incident in canal construction! This is the aggregate acreage of the slides that have been slipping in and are being steam-shoveled out. Think of a rainy season where ten feet of water falls in ten months, and still the work goes forward with only slightly slacked speed! Think of having to dispose of nearly two million carloads of spoil annually, much of it upon dirt trains which have to be backed into seas of mud otherwise known as dumps! Then you will begin

to appreciate what the brave army at Panama is doing.

IN THE HOME STRETCH

In order to appreciate fully how rapidly the canal army is moving down the home stretch in its race against time, let us refer to the map which is published as a supplement to this number and make an imaginary journey across the Isthmus, from Toro Point, Atlantic side, to Naos Island, Pacific side. First we pass the huge two-mile-long Toro Point breakwater, now being built out into the Caribbean to protect the mouth of the canal and Colon harbor from the violent "northers" which sweep down over that region during the winter months. It is now far out into the ocean and will be finished many a month before the opening date. On the east side of the canal line a second breakwater has been laid out, but it will be built only in the event that the Toro Point breakwater is unable to baffle the destructive seas single-handed.

We next enter that part of the canal which is being dug from deep water to Gatun, a distance of seven miles, at sea-level. When completed it will carry the ocean in to Gatun through a channel 41 feet deep and 500 feet wide. Already this channel is navigable to the light-draft vessels of the material-carrying fleet from Gatun, and the first five miles is practically completed. By the end of the calendar year it will be deep enough to accommodate the majority of ships which pass by way of Colon. Six months thereafter it will be completed and ready for even so huge a craft as the Olympic.

We next come to Gatun, where the great dam of the same name and the Atlantic-side locks are located. By the coming April the dam will be ready to hold 50 feet of water in check. Within 12 months thereafter it will be completed and ready for the maximum head of water, 87 feet. The work of the locks is being pushed forward so that they will be completed by the end of the calendar year, except for the installation of the operating machinery, and that will be completed five months later.

Passing through the locks, we next come to the channel through Gatun Lake. We find this now all but completed for a distance of 26 miles. By the first of May there will be nothing left to do with this stretch of more than half the total length of the canal but to put in the lighting equipment and other aids to navigation. Already the water is spreading over the bottom of the lower part of this section of the big waterway. Already Colonel Goethals is serving notice on the people who wish to see the canal while the magnitude of the work is still apparent that they had better visit the Isthmus soon. He says that belated visitors will wonder where all the work could have been done.

This 26-mile section carries us past Las Cascades and two miles into the great Culebra Cut. The next four miles represent the very backbone of the work yet to be done. In a comparatively few months there will be only about three miles of the cut above the requisite depth. Thirty steam shovels will be concentrated on that, and, if their present gait is maintained, within 16 months proud old Culebra Mountain no longer can bid defiance to the age-long desire of men for a shipway through its vitals.

The only thing that might possibly happen to delay this work further would be unexpected slides, but they are provided against from the fact that by that time the water in Culebra Cut will be deep enough to float the big 20-inch suction dredges, which would be brought up through the locks and set to work. Before them the slides would disappear as a snowbank on a balmy day.

Passing through Culebra Cut, we next come to the Pedro Miguel lock—called "Peter Magill" by the Americans on the Isthmus. Here the work is all but completed, except for the installation of the machinery, and that task is going forward in such a way that it will be in readiness before Culebra Cut is completed. The dam here—which is a small one, comparatively speaking—will be finished at an early date.

The next 2,000 yards or more of the canal will be a small lake between the single flight of locks at Pedro Miguel and the double flight at Miraflores. This

lake, which will cover nearly 1,200 acres, will be finished by the end of the present year. After passing through this lake we come to the Miraflores locks, and such unusual progress has been made on them that, although the work could not begin on them until the Pedro Miguel locks were completed, the division engineer has announced that he expects to have the work on all the Pacific locks ready for the installation of the machinery before Thanksgiving Day. Already the contractors are putting in some of the gates and operating machinery.

After passing through the double flight of locks at Miraflores we find ourselves back at sea-level again. The dam connecting the Miraflores locks with the adjacent hills is not completed yet, and will not be until the early part of 1913, being kept open to let the dirt trains from Culebra Cut through on their way to the Naos Island dumps. Much of the material for this dam will be taken from the sea-level ditch from Miraflores to the sea. This portion of the canal will be completed fully 18 months ahead of the official opening day of the big waterway. Already it is open to navigation for more than five miles inland from deep water. Only three miles out of the eight still remain uncompleted.

This rapid passage through the canal demonstrates how fast it is nearing completion. The entire channel is a little more than 50 miles long. About 37 miles of it, including the lock sites, are now down to its requisite depth, and, of the remaining 13, there are less than eight miles of really heavy work.

THE PERMANENT FORCE

From all this it will be seen that the latest date set for the completion of any part of the work is July 1, 1913. The problems are now beginning to shift from the Canal Commission to Congress. That body will have a number of problems to solve, and, if the full fruitage of the magnificent performances at Panama is to be realized, prompt action is obviously essential.

The first thing to be determined is how the permanent operating force of the canal shall be made up. We now have on the Isthmus a body of 5,000 of the best Americans who ever trod shoe leather. They are the cream of a five-year-long process of elimination. It is the desire of the chief engineer that legislation be enacted at the earliest possible date permitting him to select from this force the 2,500 men who shall constitute the permanent force for the operation of the great waterway. Many of the best men, with the sort of foresight one would expect among such people, are already accepting offers from other sources, to take effect as soon as the canal is completed. Beginning next fall, hundreds of men will be laid off every month.

Colonel Goethals will recommend a new wage scale for the permanent body. He thinks that health conditions are now such that there will be no longer a necessity to maintain the present high standard of pay. The new scale will be about 25 per cent higher than in the United States, while all of the supplies the operatives and their families will use will be furnished by the government at cost.

Another question which must be decided is what form of government there shall be in the Canal Zone, and what shall be done with the people who live there and who will not have employment on the canal. It is pointed out that the land is practically unfit for agriculture, and that to leave the people there will necessitate the expenditure of millions of dollars for sanitation that might otherwise be saved, to say nothing of the danger that might arise from having aliens on the zone in case of war. If Congress follows the recommendations of the canal authorities, the zone, except for the terminal cities, will be depopulated, leaving only those who will be connected with the operation of the canal and its works.

FIXING THE TOLLS

The knottiest problem with which Congress will have to deal in placing the canal in operation will be that of fixing the tolls. Shall it be made free to American vessels, or only to such American vessels as are not engaged in coastwise

trade? Shall it be toll-free to all ships of all nations? Shall the rate be made only such as will pay for the mere cost of operation, allowing nothing for interest on the investment or for the final return of the cost of construction? There are dozens of varying views on all of these matters.

The first feature of the whole proposition is the fact that when we have completed the canal we will have a possible ship-handling capacity of 80 million tons net register. This means that we can annually put over 200 million tons of cargo through the canal, since each net register ton of a ship, American measurement, means two and a half tons of ordinary cargo. Deducting for naval vessels and for light-loaded ships, and also for such as might go through in ballast, it is probable that the annual freight-carrying capacity of the canal will be upward of 125 million tons of actual cargo—enough to load a freight train reaching around the world. All hands realize that the more use of the canal the commercial interests of America make the more valuable will it become.

There are many who take the following view concerning the matter of tolls: If the United States is to make the most out of this great enterprise, the inland waterways of the country must be developed to the point where the Mississippi River, the Missouri River, the Ohio River, and other streams of the great Mississippi Valley shall be made navigable for ocean-going steamers, so that vessels may load direct and go to the ends of the earth. Then, the rivers to the Atlantic and Pacific seaboards ought to undergo similar development. To do these things would require a half billion dollars. Consequently, if the government should reimburse itself for the outlay for the construction of the Panama Canal, it would be in good shape to undertake inland-waterway development.

Those who subscribe to this view feel that a rate of toll can be fixed which would not discourage a ton of business from going through the canal, and yet which would serve ultimately to repay the cost of its construction. The rate which seems to meet with most favor is one dollar per net register ton. As explained before, the net register ton, American measurement, means two and a half tons of actual cargo. On that basis the rate per ton of cargo would, with the average cargo, amount to about 45 cents. Such a rate would be less than five per cent of the through rate from San Francisco to New York.

It is estimated that any rate above $1.40 per ton might drive business across the Isthmus of Tehuantepec, through the Straits of Magellan, or through the Suez Canal. The officials of the Tehuantepec route freely concede that if the rate is made as low as a dollar a ton they will have no chance at getting through-cargo business. They now get one-third of the through rate between San Francisco and New York, and between Hawaii and Atlantic seaboard points. What they are hoping for, however, is that there will result such a great boom in business upon the opening of the canal that they will gain enough distributing business to make up for their loss of through-cargo trade.

Suez will find Panama a great competitor with a rate of 45 cents per cargo ton. At Suez the Danube measurement is used, which allows only three-fifths as much space for a net register ton as does the American measurement. This results in the rates at Suez being fixed at practically 75 cents per cargo ton, or nearly double the proposed rate at Panama.

There are those who urge that the canal ought to be toll-free to all nations. They say this has been a great altruistic undertaking, and that our chief glory should be in making it usable without money or price by all the ships of all the seas. Those who oppose this idea say that the canal was built by Americans and for Americans, and that inasmuch as more than 50 per cent of the business which will pass through the canal will not touch our shores, there is no reason why it should be used to give Europe trade advantages to which we have fair title ourselves.

HANDLING SUPPLIES

It is the hope of the canal authorities that Congress will enact a law permitting the canal to furnish coal, ship-chandlery stores, and everything else that is needed by ships which would use the canal. They would not make it a government monopoly, but would leave others free to compete. The present laundry would be maintained, receiving a ship's laundry as soon as the vessel reached the canal, and delivering it back by the time the transit of the canal was finished. If authority is forthcoming, a commercial drydock will be maintained and large repair shops kept open.

One advantage vessels will have in passing through the Panama Canal is the fact that the 32-mile section between Gatun and Pedro Miguel will be filled entirely with fresh water, and that this will serve to remove the barnacles from the ships. Colonel Goethals says he expects the entire bottom of the canal to be paved with ships' barnacles in the years to come.

It is believed that the best possible way to encourage vessels to choose the Panama route is to have there at fair prices and in sufficient quantities everything that a ship thousands of knots from home may need. With the knowledge that such things may always be had and that prices will not be put up on any pleas of scarcity, the ships of the world could sail via Panama with a larger proportionate load of revenue-producing cargo than by any other route.

WORK AT GATUN

There is perhaps no other work on the whole canal more interesting than that at Gatun. Here it is that one gets a view of some of the most stupendous work on the great waterway. Gatun Dam is now taking shape and soon will be up to its full height. To the tourist it is a most disappointing sight. When he approaches Gatun he inquires where the dam is, for, be it said, the slope of the structure is so gentle that few people recognize it as a dam. Take a yard-stick and elevate one end three inches above the other, and you have about the average slope of the down-stream face of the dam. On the upstream side the slope would be represented, so far as the part under water is concerned, if you elevated the one end of your yard-stick four and a half inches higher than the other end.

The completed dam will cover some 400 acres of ground and will contain 21 million cubic yards of material—enough to make a wall of earth three feet high and three feet thick and reaching nearly half way around the world.

The dam has been full of surprises, but very different kinds of surprises from those which the pessimists were expecting. The site was for a long time called into question. When Colonel Goethals took charge he immediately put into effect a policy of not taking even the smallest thing for granted when he could prove a thing by actual test. After the assertion had been made thousands of times that there was an underground river flowing beneath the dam site, he honeycombed the whole area with borings and sunk a big shaft down to solid foundation, so that he could see with his own eyes. He found almost none of the conditions the fearful ones had pictured. But, in order to forestall all criticism, he planned the dam so as to include triple interlocking steel sheet piling across the valley, driven down to bed-rock, and a dam that should be 135 feet high—50 feet above the water level.

Then came the famous "collapse" of the dam, wired to the American press by a Panama newspaper reporter. People did not stop to think that there was as yet no dam there to collapse, and President Roosevelt was alarmed at the widespread uneasiness. It was this that led him to send the board of engineers to the Isthmus, accompanied by President-elect Taft.

The net result of the trip was that the engineers declared the dam was being built needlessly high, and that there was no occasion whatever for the use of the piling. So it was cut down to 115 feet, and the piling was omitted. After all, the story that shook the confidence of the American people in the dam bore good fruit in the resulting saving in the construction of that dam. The only

criticism of it today is that it is still larger than was necessary. Colonel Goethals admits that if he had been building it for private corporations he would have made it smaller. But "concede everything else to safety" has been his policy from beginning to end.

We see this same attitude in the matter of providing for the disposal of surplus water coming into Gatun Lake during the high stages of the Chagres River. The Gatun spillway is being built so that it can discharge 137,000 cubic feet of water a second, the water issuing at a speed of 35 feet a second.

This will take care of the maddest flood that history records in the Chagres. In addition to this, the big culverts of the locks can be turned open and a flood of 170,000 feet a second is provided for. Yet the Chagres can flow at its highest known stage into the Gatun Lake for 5½ hours, with no discharge at all, and raise its level only one foot, and can raise seven feet without doing damage.

In other words, although the Chagres could do its worst for a day and a half, without a drop of water going over the spillway, without doing any damage, the canal authorities have arranged to pass out more water per hour than the Chagres can possibly bring down, and have not presumed at all upon that day and a half advantage over the Chagres.

EVERY CONTINGENCY PROVIDED AGAINST

Still another incident serves to illustrate the wonderful care that has been taken uniformly not to draw a rosier picture than conditions warrant. Colonel Goethals always declared that the material which would constitute the hydraulic core of the dam would be sufficiently impervious to water to prevent any dangerous seepage. But experience is proving that there is no seepage at all. A long pond is maintained at all times on the crest of the dam, and into this the big dredges are pumping millions of gallons of water. The clay settles and part of the water runs off. The remainder stays there, seeking out every possible crack and crevice, a sort of hydraulic stone-mason, who tightens up every minute space and offers a perpetual guarantee that when he finishes his work all will evermore be well.

Another illustration, showing how more than cautious are the responsible heads of the canal in their efforts to insure its integrity, is the provision against accidents in the operation of the locks. The fact that they are, so to speak, "double-tracked," so that even if things should go wrong in the one set of locks, the other set will be available, is in itself regarded as practically eliminating danger. But this is only an incidental precautionary step.

In order to guard against danger from a ship ramming the upper or lower gates, there is a heavy chain stretched across the channel, with the ends attached to giant hydraulic paying-out machinery. These chains and their paying-out attachments are strong enough to stop a 10,000-ton steamer traveling at the rate of five knots an hour. But even if they should fail to bring a vessel to a stop and it should ram down the outer gates, there would still be a second pair of gates across the channel. Not once in millions of times would the first gates be rammed, and as for the next pair, it is almost beyond possibility that they should be reached by the vessel and forced open.

But suppose the chain failed to stop the ship, then that the outer gates also failed, and then even that the almost impossible should happen—the second pair of gates rammed: even that contingency is amply provided against. A large cantilever bridge will be ready at all times to be swung across the channel. From this there would be let down a series of nickel steel wicket girders into the madly rushing waters. The lower ends of these girders would engage a sort of offset in the lock floor, making a series of small, nearly perpendicular railways, on which large steel sheets mounted on rollers would be let down. By the time all of the girders and sheets of steel were in place, there would be an effective steel dam interposed to replace the damaged gates. Such an emergency dam is to be found at the Soo locks. Although it had grown so rusty by disuse that it could not be operated by power when an acci-

dent did happen, it was placed in position by hand and effectively served its purpose.

But even here the manifold precautions to make impossible serious accidents in lock operation do not stop. Statistics of lock canals show that perhaps 90 per cent of the accidents in lock operation arise from vessels entering and leaving locks under their own power. There seems to be an impossibility to get shipmasters to respond to every signal given exactly as given and at the instant given.

To secure the proper coördination between the ship itself and the lock machinery at Panama, it has been decided that no ship shall be allowed to negotiate the locks under its own power. Therefore a series of electric towing engines will be installed on the side walls of the locks. When a ship approaches, it will be brought to a standstill outside the locks. Then four of these towing engines will be attached to it by means of hawsers—two at the stem, to pull it into the locks, and two at the stern, to hold it back and to stop it at the proper time. No canal on earth now in operation has more than half as many precautions to insure successful operation as the Panama Canal will have.

REMARKABLE EFFICIENCY

One of the most remarkable phases of the work of building the Panama Canal has been the unparalleled development of engineering efficiency. For instance, the cost of steam-shovel operation has been cut from 11.5 cents a yard to 8.88 cents a yard. The cost of hauling away the spoil has been cut down from 18.54 cents a yard to 15.22 cents, although the distance of transportation has increased from 8 to 12 miles. A ton of dynamite has been made to do twice as much work in 1912 as it did in 1908. They save $50,000 a month by shaking their cement bags.

When Colonel Goethals took charge of the work at Panama the incessant and insistent demand of the people at home was that he should "make the dirt fly." He recognized that if the canal were to command the support and confidence of the people during its construction, "making the dirt fly" would have to be the first aim of the canal diggers; the cost of making it fly would have to become a secondary consideration. How well he succeeded is shown by the tremendous results of 1908—37 million cubic yards of material removed.

Thereafter one heard little talk about making the dirt fly, and the Commission was then able to bend their energies to the work of making it fly economically as well as to making it fly fast. A tightening-up process here, the elimination of lost motion there, the invention of some time-saving device at another place—all served to make the operations more economical and to save millions of dollars. So great has been the progress in developing efficiency on the Isthmus that they have cut the cost of excavation in Culebra Cut by more than one-third.

THE USE OF CONCRETE

Nowhere else in the world has there ever been such a vast amount of masonry constructed on any single engineering project as is being built in the locks and spillways of the Panama Canal. In times gone by the masonry of all great projects, like the Pyramids of ancient times and the Assuan Dam of today, was made of natural rock; at Panama they make artificial rock, and make it so fast that one scarcely can believe his eyes. The concrete required on the whole project amounts to more than four and a half million cubic yards.

This is enough to build up an airline street from New York to Washington, with six-room houses on both sides. Those houses would furnish shelter for a population the size of the city of Indianapolis, taking the census returns of the number of people to the average American dwelling as the basis.

Expressing the magnitude of the project in another way, it would make a regulation sidewalk nine feet wide by six inches thick, reaching more than twice around the earth.

The locks at Gatun require two million cubic yards of concrete. Those on the Pacific side, being built with two flights at one place and the third at another place, require nearly 200,000 yards more

than the single triple flight at Gatun. The Gatun spillway claims approximately a quarter of a million yards.

Nowhere else in the world does one get a more vivid impression of the versatility of concrete than on the Panama Canal. They are using it to make the giant locks, and with equal success in constructing the huge piers and docks at the ends of the big waterway. They have been trying out a cement gun to shoot cement—sand and water, mixed as it passes out of the nozzle—against the sides of the Culebra Cut, to form a coating of solid artificial rock, although the experiment has not proved as much of a success as had been hoped. They are building light-houses and other aids to navigation out of concrete, and have even gone so far as to build barges of this material.

Nowhere else in the world is there to be found such extensive concrete mixing plants or such remarkable machinery for handling the material. Millions of barrels of cement had to be carried to the Isthmus and millions of yards of stone had to be quarried and crushed at Ancon and Porto Bello. Sand by the hundreds of barge-loads had to be brought from islands in the Atlantic and the Pacific to keep filled the seemingly insatiable maws of dozens of giant mixers, which receive some ten tons of sand, cement, crushed stone, and water, whirl them around for a minute in a sort of digestive process, and then dump the mass out in the shape of unhardened artificial stone.

Many new problems in concrete construction have been worked out at Panama. The effect of sea water on concrete, the time of setting for such huge masses, and a dozen other matters, upon which depended the stability of the locks and the integrity of the waterway, had to be met. All of them were met in the spirit of accepting nothing as proven until it was proven by actual physical test.

The world is now in the age of concrete, and the Panama Canal must go down into history as the greatest effort man ever has made and perhaps ever will make to simulate the processes of geologic ages and do in days what nature required unreckoned years to accomplish.

HEALTH CONDITIONS

Turning now from the engineering features of the canal to the other phases of the work, we find that here equally remarkable conditions prevail. While we are building a 40-foot canal in less time than it took the French to discover that they could not build a 15-foot waterway, and are making it a glorious success with no greater outlay than it required for the French to make the most dismal of failures, it is largely because extravagance and disease conspired against the French as they never did before or since against any people. They actually had brought over snow-shovels, for what no mortal man knoweth, and they also were supplied with thousands of torch-lights for the celebration procession. Fine motor-boats were shipped to Culebra in anticipation of the day when water would be running into the canal.

But then the French did not know about the yellow-fever mosquito. They actually made things easier for their tiny but most deadly foe. They set the posts of their hospital beds in little pans of water to keep the ants away—and the yellow-fever mosquito reveled in it.

When we went to Panama we had learned the secret that the mosquito had kept hidden from humanity for all the generations before. If the Spanish-American War had taught the necessity of the Panama Canal, it also furnished the lesson which made the work possible. The lessons of sanitation at Havana, and the making out of a complete case against the yellow-fever mosquito by Drs. Reed, Carroll, and Lazear, put into practice by so able a sanitarian as Dr. Gorgas, at Panama, has served to make the Isthmus almost a tropical health resort.

When it is considered that the proportion of colored population on the Isthmus to the white population is larger than obtains in any American city, and that in spite of this the Canal Zone death rate is as small as that of the most healthful of American cities, the success

of the sanitary campaign becomes remarkable.

Of course there is no region on earth where so much money is spent in proportion to population or to area for keeping the people in health as at Panama. Did we spend as much at home for sanitation and hospitals in proportion to population as we spend at Panama, our total outlay for health would aggregate one-third of all the expenditures of public money by the United States, the States, the counties, municipalities, and school and road districts of the country combined. Did we spend as much in proportion to area, our total outlay for health purposes would amount practically to 12 billion dollars a year.

It has been said that there might be both a congress of nations and a congress of mosquitoes on the Isthmus. Counting the islands of the sea as separate countries, it is said that there are 52 countries represented on the Isthmus, and the number of kinds of mosquitoes once was many times more.

But the mosquito cannot operate successfully in oil stocks; water is his line. A baby mosquito must live in the water, and is under the necessity of making some 8,000 trips to the surface while growing to adulthood. It comes up for air. If it happens to get a single speck of oil down its little gullet on any one of these many trips, there is a funeral in mosquitodom soon thereafter; and thousands of barrels of oil have been scattered upon the mosquito-troubled waters of Panama. Doing this, keeping the grass cut, the drains all open, and dangerous diseases out of the ports represents a large proportion of the health work at Panama.

THE MAN AT THE HELM

When President Roosevelt called upon Lieut. Col. George W. Goethals to go to Panama and dig the canal, he selected a leader of men who is entitled to rank with the greatest captains of history. To study him at close range is to know one of the most remarkable men of the times. He cares just about as little for popular applause as any man I have ever known. He always keeps himself in the background. Tall, broad-shouldered, bronzed-faced, with snowy white hair and mustache, he is physically a man among men. Intensely loyal to his military training, he cares as little for its fuss and feathers and trappings as did Grant or Stonewall Jackson.

One day I was traveling with him across the Isthmus to Colon, and I remarked that he must be the busiest man on the Isthmus, and that yet I had never seen a man who always seemed to have as little pressing work before him. "I have a contempt for the man who is always trying to make it appear that he is busier than other people, and that they must wait on him," came the laconic reply.

At another time I remarked that he seemed to have solved all of the problems of the canal and had the whole force in smooth working order. "If you were to drop into my office any Sunday morning, when it is open to the lowest workman on the canal, you might think differently," he responded. "I think," he continued, "that the best way to keep men contented is to give them a hearing. I may not be able to do what they would wish, but the very fact that I hear them makes them feel that I want to do the right thing by them."

In speaking of the progress of the work in Culebra Cut, the Chief Engineer revealed to me a species of greatness above anything I have ever seen. He has worked and slept with his task for five years, keeping at it with unrelenting zeal and calm enthusiasm. The whole world rightly gives him great credit, but in one generous handful he turned the bulk of it over to his predecessor, doing it in about the following words: "The people talk about the success of the army engineer at Panama, but it was fortunate that Mr. Stevens preceded us. The real problem of digging the canal has been the disposal of the spoil, and no army engineer in America could have laid out the transportation scheme as Mr. Stevens did. We are building on the foundations he laid, and the world cannot give him too much credit."

Colonel Goethals has special trains, private cars, and motor cars at his dis-

posal all the time, but as a rule he rides on the regular trains, in the ordinary day coaches, and goes about among the men on the work, keeping in touch with them at all times.

HUMORS OF CANAL BUILDING

Not everything is grim and determined work at Panama. A little fun now and then crops out, mostly imported from the States, and being brought by Congressional delegations who visit the canal. A year or two ago a Western Senator was in one of these delegations, and at a hearing on the Gatun Dam he inquired: "Colonel, how is it that so small a body of earth as the Gatun Dam can hold in check such a tremendous body of water as the Gatun Lake?"

Colonel Goethals replied that it was explained by that well-known principle of hydrostatics under which the pressure of a body of water is determined entirely by its height and not by its volume. Still the Senator could not see it.

Then Senator Knox, now Secretary of State, addressed the Western Senator, saying, "Senator, if your theory were true, how could the dikes of Holland hold in check the Atlantic Ocean?" Thereupon the Western Senator saw the point and joined in the laugh at his own expense.

Another distinguished visitor, traveling on a train which had just backed off of the Panama railroad on to the relocated line, wanted to know of the Chief Engineer if the relocated line were the same gauge as the other.

A young man in the diplomatic service of the United States, after having witnessed the putting of a model of the *Olympic* through a model of the Pedro Miguel lock, asked Designing Engineer Cornish how it was that they got the water into the locks without pumping it in.

There is a perennial circus on the Isthmus in the shape of the 30,000 West Indian negroes who are helping dig the canal. I have the word of the Chief Engineer that one of them has frequently been seen to go to the post-office, get a letter, place it on his head, put a stone upon the letter, and walk away. Upon one occasion three Martinique negroes were set to removing material with a wheelbarrow. They loaded it, and then one stooped down, the other two lifted it to his head, and he walked away with the load.

When one reflects that the 30,000 or more negroes and Spaniards who make up the common labor on the canal were all untrained and undisciplined, and that the force of negroes changes almost every year, it becomes all the more remarkable that such great feats of engineering performance should be possible at Panama.

SEA-LEVEL CANAL IMPOSSIBLE

As one who originally believed that a sea-level canal should be built, I freely acknowledge my belief today that if we had undertaken such a waterway, we would have retired defeated and disappointed, as did the French. The work on the present project has absolutely vindicated the judgment of those who opposed a sea-level canal. In the first place, the width of the waterway perforce would have been so narrow that it could readily have been blocked by some future Hobson with a *Merrimac*. In the second place, only God knows how much material would have had to be taken out of Culebra Mountain before its sides would have stopped slipping into the cut. In the third place, there would have had to be tidal locks, which would have been in more danger of being put out of commission than the present ones. In the fourth place, there would have had to be a higher dam at Gamboa than there is at Gatun, and a fairer mark it would have been for the aëroplane. No one ever leaves the Isthmus now without registering a vow of thankfulness for the wise course that was pursued in making it a lock canal. It is so obvious that the veriest layman can see it.

FORTIFICATIONS

With the two great forts at the two ends of the canal fitted out with four 14-inch guns, six 6-inch guns, and twelve 12-inch mortars, with twelve companies of coast artillery, one battery of field artillery, four regiments of infantry, and one squad of cavalry, there is not

likely to arise a time when these fortifications, backed up by the American navy, will fail to command a proper and wholesome respect from other nations.

It is rather remarkable that the only objections that have been raised to fortifying the canal have come from our own people. To have made it neutral would have placed the United States in a peculiar position in case of war. Either we would have had to refrain from using it for our war ships, or else we would have had to permit the enemy to use it on equal terms. That would have meant that good American citizens, operating the canal, might have been forced to put the enemy's fleet through the waterway—practically compelled to commit a sort of legalized treason against their own government by giving aid and comfort to the enemy.

A NEW COMMERCIAL MAP

As intimated in the beginning, wonderful and world-affecting results must grow out of the completion of the canal. Cities that are today the way stations on the international routes of trade will grow up into veritable metropolitan communities. Other cities which are supreme today may fall back into second place a generation hence. When the Turks captured Constantinople and cut off the trade between the Orient and the Occident, Columbus sailed in search of a new passage to India and discovered a new world. When the Panama Canal is completed and the generation passed during which the highways of the oceans will be changed, the United States will have discovered a new world of international trade, which will so link and bind the nations together that the great waterway, built primarily for defense, will become one of the greatest factors in the promotion of universal peace, and the prophecy about swords being beaten into plowshares and spears into pruning-hooks will have been brought nearer to fulfillment.

AMUNDSEN'S ATTAINMENT OF THE SOUTH POLE

THIS page was already on the press when the cable came from New Zealand announcing the attainment of the South Pole by Roald Amundsen, December 14-17, 1911. Amundsen is a gold medalist of the National Geographic Society, having been awarded the Hubbard Medal of the Society for his achievement of the Northwest Passage from the Atlantic to the Pacific, and for his explorations and observations on that remarkable voyage of discovery. The Society rejoices at his well-earned success in attaining the coveted goal at the far South.

Many geographers had feared that Amundsen would yield to the temptation of following, for a considerable part of the way to the South Pole, the route previously discovered and opened by Shackleton; but his account shows that he was not satisfied to do this, and in consequence he has made discoveries and surveys that are entirely new.

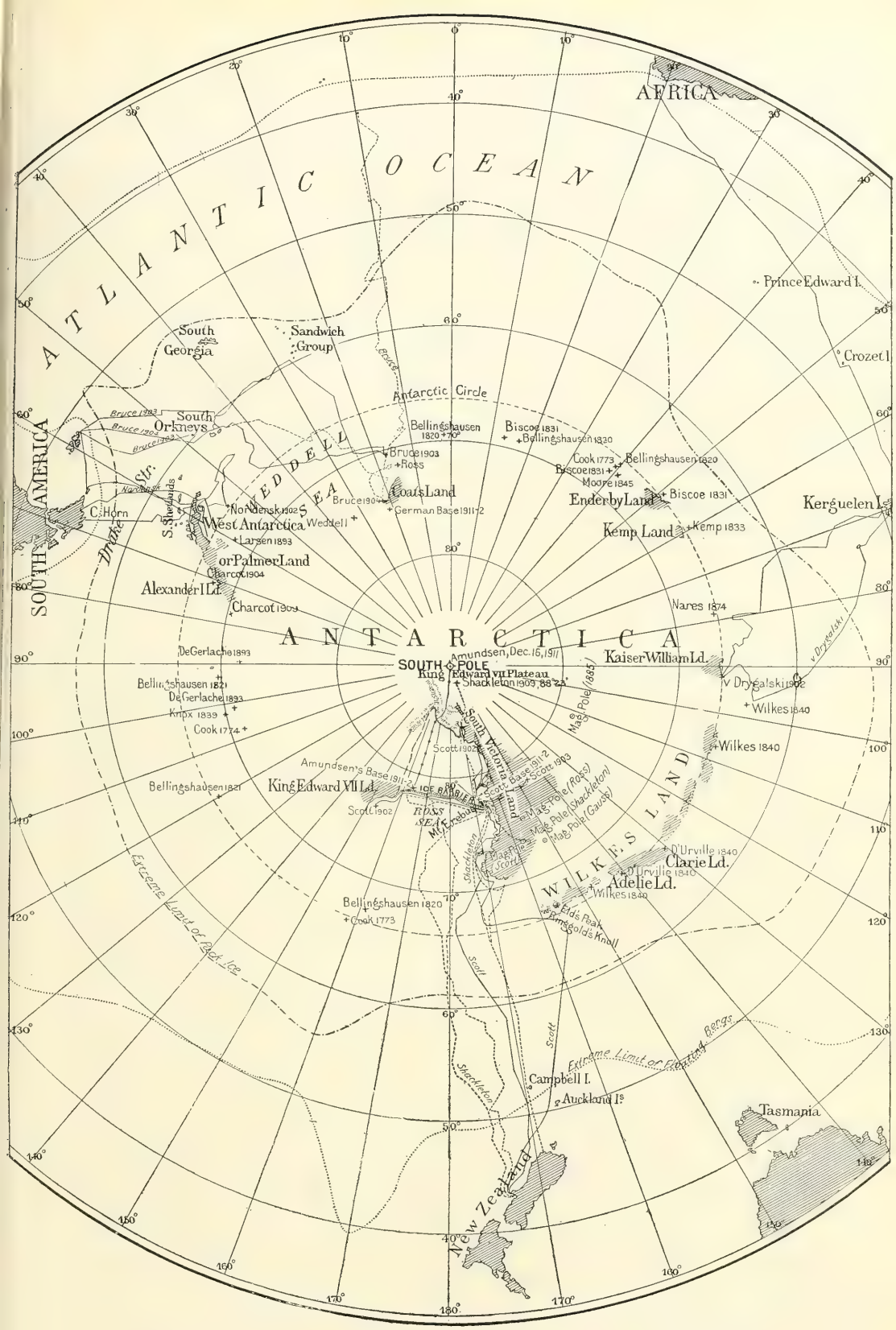
The whole distance traversed by him—approximately 700 miles from his base, where he moored his ship to ice-front—to the pole itself, appears to have been across previously untraversed and unknown ice and land. He has defined the eastern and southern boundaries of the Great Ice Barrier, that vast plain of floating ice which flows down from the great Antarctic Continent, and whose western boundary had been defined previously by Shackleton. This enormous glacial ice plain is one of the wonders of the world. It is a solid mass of ice, floating for the most part, approximately 800 to 1,600 feet thick, and covering an area of about 100,000 square miles, or considerably larger than New York, Massachusetts, New Hampshire, and Vermont combined.

Amundsen found traveling across the barrier comparatively easy. He marched 382 geographical miles due south across the plain until he was confronted by the

A SPECIAL EXHIBITION OF THE SACRED TOOTH: KANDY, CEYLON

Photo from Eliza R. Scidmore

The Sacred Tooth (of Buddha) was brought to Ceylon from India by a princess and enshrined in a palace of its own. It was carried off as loot by one of the Malabar raiders of Ceylon ten centuries later, recaptured and returned to Ceylon, and treasured in a hidden shrine until 1560, when the Portuguese took it and carried it to India, where they burned it with great pomp and threw the ashes into the sea. The King of Kandy thereupon had a new tooth, 3 inches long, made of choicest ivory, and enshrined in the place of the lost one. The new tooth is shown in this picture (see pages 117, 150, and 151).



OUTLINE MAP SHOWING ROUTE OF AMUNDSEN TO SOUTH POLE

Captain Scott's base is also shown. Scott was planning to follow the route of Shackleton. The Japanese South Polar expedition is now camped near Amundsen's base; the Australian expedition has made a base on Clarie Land; the base of the German expedition is on the other side of the continent on Coats Land.

high mountains. Here he was so fortunate as to find a glacier route up to the inland plateau easier than the Beardmore Glacier, which was used by Shackleton to ascend to the inland plateau three years before.

Amundsen and four companions accomplished the ascent from the ice plain to the plateau, 10,500 feet, in the marvelously short time of four days. He was now about 275 miles from the pole, and thence onward his greatest difficulties were encountered. The rare atmosphere at this high elevation made breathing difficult. Storms delayed them, but they pushed on and reached the pole December 14, staying there for three days. The pole is at an elevation of 10,500 feet. Amundsen reports a lofty chain of mountains, some attaining 15,000 feet, extending southeastward as far as he could see. The chain is probably an extension of the lofty range seen by Shackleton, and probably stretches across the South Polar area to Waddell Sea.

Shackleton in 1909 reached a point so near the South Pole that we have known pretty accurately the conditions at that extreme point, so that the part of Amundsen's narrative dealing with the pole itself, while highly entertaining, is not so important or so novel as it would otherwise have been.

Amundsen owes his success to his very carefully prepared equipment, to his splendid dogs and his skill in handling them, and to many years of previous experience in battling with the ice and snow of the far North. Next to Peary, he is the most experienced traveler on ice in the world. The following notes from his cable to the New York *Times*, to whom the world is indebted for his story, illustrate the minute care with which every detail was anticipated:

"Washing was a luxury never indulged in on the journey, nor was there any shaving; but, as the beard has to be kept short, to prevent ice accumulating from one's breath, a beard-cutting machine which we had taken along proved invaluable. Another article taken was a tooth extractor, and this also proved valuable, for one man had a tooth which became so bad that it was absolutely essential that it should be pulled out, and this could hardly have been done without a proper instrument.

"For food we relied entirely on pemmican, biscuits, chocolate, powdered milk, and, of course, dog meat. The dogs were fed on pemmican.

"In my opinion we had the best and most satisfying provisions possible. In fact, from the beginning to the end of the journey we never felt an undue craving for something to eat or any feeling of not having had sufficient nourishment."

BIRD'S-EYE VIEW OF PANAMA CANAL

A GRAPHIC picture of the entire Panama Canal is given in the "Bird's-eye View of the Panama Canal," published as a supplement to this number of the Magazine. The great features which make the canal so remarkable—the giant Gatun Dam and spillway, the enormous cut at Culebra, the big artificial lake which forms about one-half of the canal route, and the long double locks—are presented so clearly that the reader vividly realizes the entire work. For the convenience of the readers of the Magazine, a limited edition of the map has been printed on heavy stock suitable for framing, and may be obtained at the offices of the Society for 50 cents per copy.

IMPORTANT NOTICE

THE very great popularity of the Magazine during the last several months, which has necessitated increasing the edition by more than 50 per cent, delayed the publication of the January and February numbers. The March number will follow very quickly, and we hope soon to catch up with the calendar.

The March number of the Magazine will contain a comprehensive map of China and its territories, 18½ x 21 inches.

VOL. XXIII, NO. 3 WASHINGTON MARCH, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

THE FORGOTTEN RUINS OF INDO-CHINA

The Most Profusely and Richly Carved Group of Buildings in the World

BY JACOB E. CONNER

AMERICAN CONSUL AT ST. PETERSBURG; FORMERLY AMERICAN CONSUL AT SAIGON, CAMBODIA

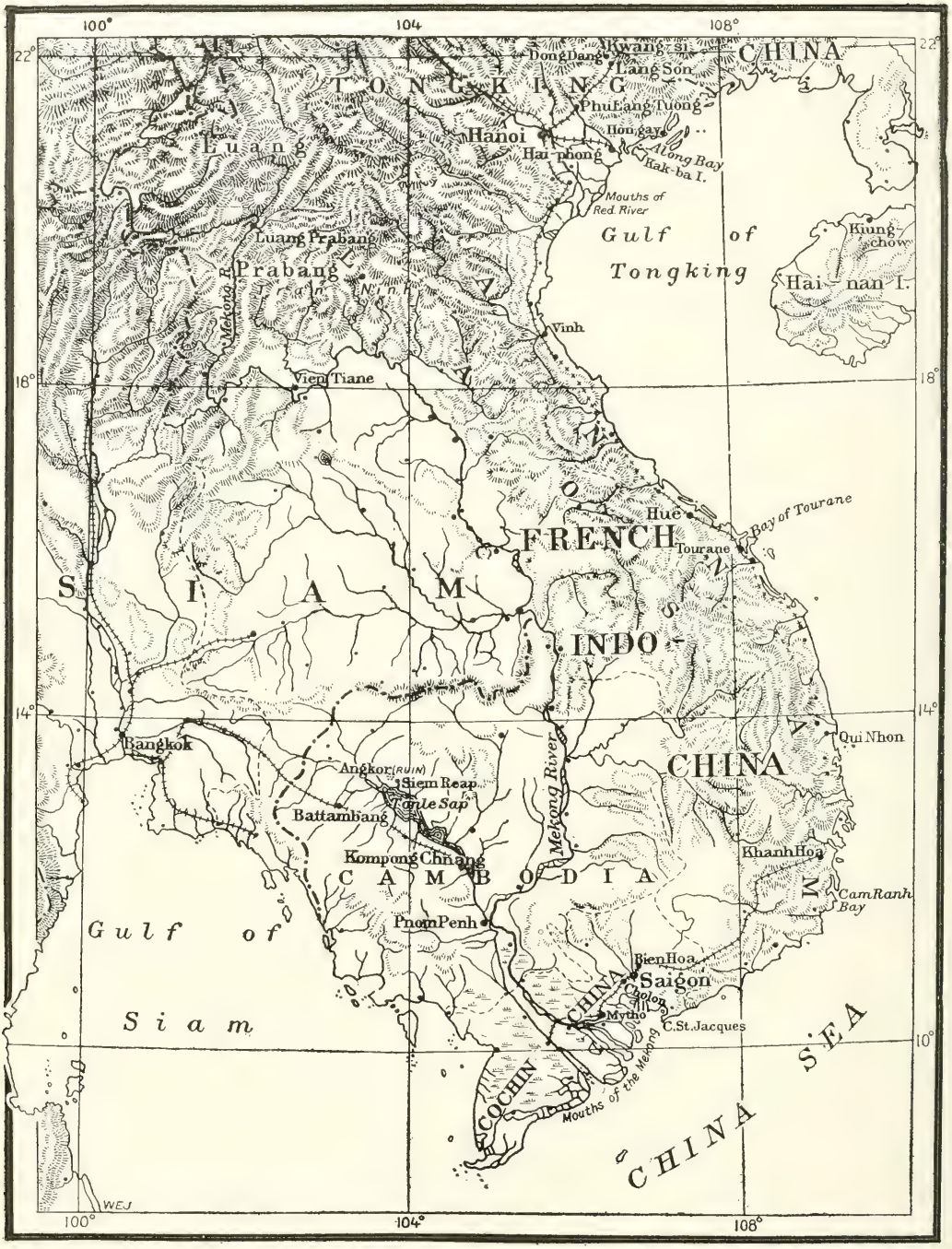
OUTSIDE of the Siamese and Cambodians, very few people have heard of Angkor, or know that such a nation as the Khmers ever lived, conquered, worked, and perished from the face of the earth. In America, even now it is doubtful if there are many who have heard of Angkor Tom and Angkor Wat, so completely have these splendid ruins been hidden in the Cambodian jungle and kept from civilization by natural barriers.

Up to recent years not many travelers ever visited Angkor, and some of those who did never returned to tell the story, for the country has been from time immemorial inhospitable to strangers. It is said that the Romans sent an envoy in the time of its greatest activity. The Chinese have from time to time sent envoys and made treaties, and have left the earliest descriptions so far discovered and deciphered. Marco Polo mentioned the place, but did not see it.

The Dutch, in the 16th century, sent an ambassador, and the natives assassinated him. Later the Portuguese and Spanish visited them; but the country remained a mysterious and forbidden land, the thrall of Siam for many years. Then the French came, in the middle of the last century, and the geographical limits of the protectorate of Cambodia have been but recently defined.

During the long centuries of their isolation and seclusion, these buildings have remained in an unusual state of preservation. And still they keep their secret, in spite of all the books and treatises that have been written, for the language of their builders is undeciphered. But if the mystery of their origin appeals to the imagination and spurs the archeologist to solve their riddle, the artist and the architect will be no less interested when the beauty of their structure and decorative detail are laid before them; and these, fortunately, need no interpreter.

There are no roads to Angkor—none but a wretched bullock-cart road, beginning at the river, some three or four miles away, and ending at the ruins. From the outside world there is no feasible means of approach except by water, and this is attended with some difficulty. An effective barrier is stretched across the way in the shape of a shallow lake. At the close of the rainy season, say from October 15 to December 15, this lake is deep enough to be navigable by steamboats. Under favorable conditions



OUTLINE MAP OF FRENCH INDO-CHINA, SHOWING THE LOCATION OF THE RUINS AT ANGKOR, CAMBODIA

this period may be extended two weeks earlier or two weeks later, but one is liable to be disappointed if he attempts the journey outside of these dates, and outside of the three months indicated it is utterly impracticable.

A trip anywhere must have a beginning, and this begins at Saigon, the capital of Cochin China, in the southeastern corner of the Asiatic mainland, because Saigon is the nearest practicable seaport. There are no hotels at Angkor, nor any place nor any people to provide you food or lodging. A rest-house is there, consisting of roof, floor, and walls, and that is all.

And that is why I started for the ruins one morning early in December with a steamer-trunk full of tropical clothing, a steamer-rug, a camp-bed, a Cambodian mattress (splendid thing for comfort), a supply of provisions, and a Chinese cook. A railroad journey of 44 miles brought me to the end of the line at Mytho. From this point the journey is up the broad Mekong River by steamboat for the next 24 hours; and you are not sorry when it is ended, either, for the accommodations are anything but luxurious.

The Mekong is one of the world's greatest streams; it is the one great river of the peninsula of Indo-China. If you follow it up far enough, you will find its headwaters not far from the great central plateau of Asia. In its middle course it is a magnificent stream, and in its lower it is another Mississippi delta, spreading out over and embracing the broad, flat plain it has created, and reaching the sea at last through a number of bayous and passes. A few years ago the crocodile and rhinoceros frequented its banks, but these have now retreated farther up-stream.

A sheet of yellow water a mile or so wide, fringed with cocoanut and arica palms; some banyans, bananas, and a tangle of liana vines; an occasional bird or two; a native sampan, a Chinese junk; patches of rice and acres of swamp land; no hills in sight to relieve the monotony—such is the vista of the first day's journey, which lands you at Pnom Penh, the modern capital of Cambodia.

An attractive little place is Pnom Penh, with well-paved streets—it takes the French to make good roads and keep them good—a gentle monsoon to cool the air; a few characteristic buildings of the Cambodian royalty, suggesting "a general flavor of mild decay"; a pagoda with a silver-plated floor and an absent-minded looking Buddha made out of glass, attended by a priestess clad in gold and glittering with diamonds; a "library" without a book in it; processions of Buddhist priests in bright yellow robes; natives in bright-colored silks and cottons; and, above all, the "Pnom" itself, a structure erected as a monument and possessing some lines of beauty that more than atone for its grotesque features.

His Majesty King Sisowath appears to have an easy, comfortable time of it, and that is the greatest desideratum to a sovereign whose sway is in the tropics. He is surrounded by a numerous *entourage;* he has his ministers and all sorts of supernumeraries, and can go through the motions of governing, draw his pay for it right royally, and still be free from any distressing consequences and annoying details. His minister of war has charge of his elephants, used now in his military parades rather than for warlike purposes.

The story goes that a few years ago, like any up-to-date sovereign, he felt the need of a navy for his admiral to command. A dismantled cruiser was kindly furnished him by the protectorate, and his majesty proceeded to pay a visit to the King of Annam. Returning from the visit, the whole royal party took to sampans, such as they had always been acquainted with, and the discredited cruiser was reduced to tugboat duty, and so returned to Pnom Penh convoying a whole fleet of sampans.

It is startling to hear a group of Cambodians talking and laughing together, especially after one has grown accustomed to the sound of Annamite and Chinese voices. The latter, being monosyllabic and tonal, cannot change the quality of tone without at the same time changing the meaning of the word, whereas European languages can modulate the tone at will, and are thus more flexible and expressive of feeling. When you hear the hum of Cambodian voices

Diéulefils Collection

ROYAL PAGODA WITH SILVER FLOOR, AT PNOM PENH

This building stands within the palace grounds of King Sisowath, and, like all the more recent architecture of Cambodia, it shows Siamese influence

Dieulefils Collection

PAGODA TO THE LATE KING NORODOM, AT PNOM PENH

This monument is a good illustration of very bad taste, strongly contrasting in this respect with the ancient works, portions of which are used in the composition. Kings, princes, and dignitaries devote a part of their fortune to building monuments like this. They thus acquire merit in the eyes of Buddha and gain their supreme reward of Nirvana. The pyramids at the corners of this pagoda are designed to receive the ashes of the donor or of members of his family.

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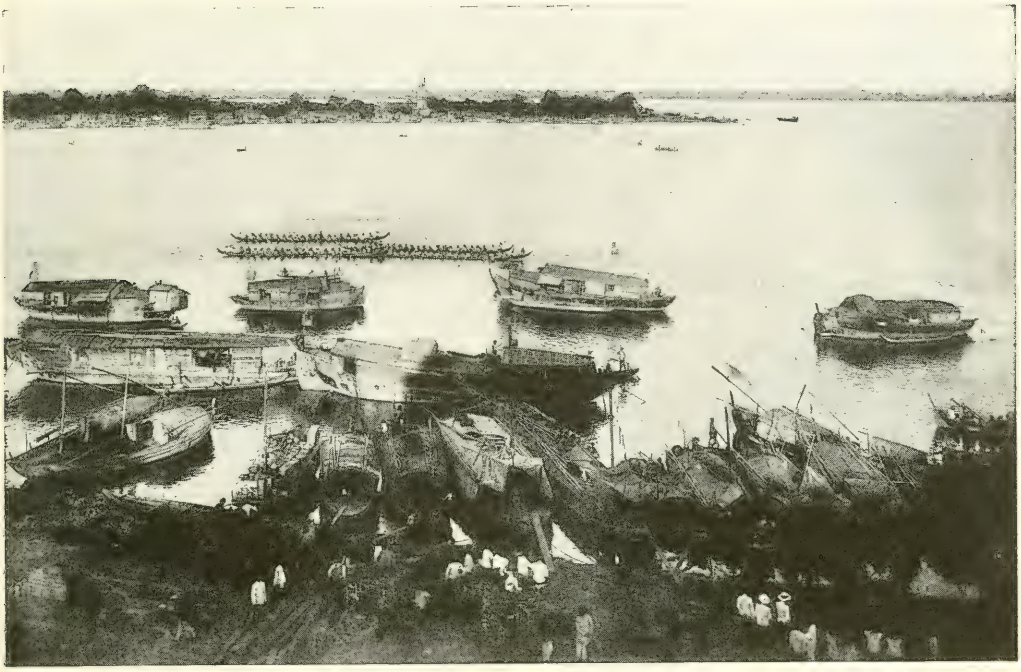
TOMBS OF THE BONZES (PRIESTS), AT THE PAGODA OF KING NORODOM

The size of the pyramid or tomb indicates the **sanctity** of the bonze whose ashes it contains



ANNUAL REGATTA AT PNOM PENH

The racing boats, or pirogues, resemble those shown in the bas-reliefs at Angkor, and are propelled, not by means of oars, but by vessels held in the hands of the rowers resembling shallow wash-bowls.

you realize the difference at once, and you look into those faces again, half expecting them to look familiar—but they don't.

No; these people are at the meeting-place of the Aryan and Mongolian civilizations. Their language, religion, their entire civilization, is derived from the Hindu; but what races they themselves are derived from it would probably take a long time to enumerate, if one knew them.

At Pnom Penh we leave the Mekong and continue up one of its tributaries. It is really a tributary now, for the water is pouring down in a swift current from the lake, Tonle Sap, though a few months later it will be pouring the other way. Soon the scenery changes; the stream broadens, hills begin to appear on the horizon. We reach the village of Kompong Chnang.

We are told that Kompong signifies *anchorage,* and, looking at the map, we see that most of the villages are so designated. What does this mean? Why, it means that the villages are anchored, to be sure; for look at this one. Kompong Chnang is a floating village; not a lot of sampans fastened together and moving about, as they do at Canton, but houses—rather substantial looking, too—built, some of them, in European fashion and mounted on piles of bamboo laid flat in the water. The bamboo is a series of water-tight compartments joined end to end, and it floats like a straw. Over yonder is what appears to be a bridge, beginning somewhere right in the midst of the water and running off into the distance, probably searching for solid ground, which is pretty hard to find in this region.

Meanwhile the houses are all nodding and bowing to each other in pleasant, neighborly fashion, for all the world like the citizens of Saigon when driving on the Tour d'Inspection; and so we leave them.

Night descends as we enter the lake and steer toward the opposite end. Its waters are rapidly receding, and in a few

Dieulefils Collection

TYPICAL MEN AND WOMEN OF CAMBODIA

The people of Cambodia are a mixture of races—Malay, Annamite, and Chinese

CAMBODIAN TYPES, MOSTLY WOMEN

Note the sarong (skirt), modified in the Siamese fashion into something like trousers, and worn by both sexes

Dieulefils Collection

DANCERS OF THE ROYAL PALACE

Dieulefils Collection

CAMBODIAN WOMEN

Unlike the other peoples of Asia, the men of Cambodia take excellent care of their women, and do not allow them to perform any laborious work

more weeks it will be too shallow for even a sampan to navigate, though at its maximum season it has a depth of 20 meters. Seventy miles it is in length and 20 miles across, and a smooth and beautiful sheet to look at now; yet at the beginning of the rainy season it is only so many square miles of mud. At midnight we reach a point on the coast opposite the mouth of a little stream —at least, we are told that there is a stream there. All that one sees is the surface of the lake; a line of trees half of a mile away, apparently marking the shore, and the sampans ordered in advance waiting to take you to land; for this is where you leave the steamer and begin to depend upon your own supplies.

By one o'clock bag and baggage, including "Van," the indispensable Chinese cook, was transferred to the sampan and the two Cambodians rowed toward the line of trees. These showed at one point a narrow opening, and I now saw that the reason I did not see the little stream at first was because it was several feet beneath the surface of the lake. I discovered, too, that the line of trees was not the shore, but the edge of a submerged forest, and that there were five hours of rowing before we reached the little village of Siem Reap, where the bullock carts were waiting to continue the journey (p. 220).

CAMBODIAN MOTHER WITH INFANT

As every traveler knows, this is the method of carrying a child used throughout the Orient

It is a trip not soon to be forgotten, this voyage from midnight to morning through a submerged forest, with a full moon directly overhead in a clear sky. Once inside the outer line of trees, taller and stronger than their fellows, the ordinary forest features were reproduced—glades and clumps of trees, but the watery way everywhere. The rounded tops of the larger ones reached but 10 or 15 feet above the water, but they brandished their harsh and rustling foliage triumphantly. The smaller ones, still submerged, with no foliage to boast

Dieulefils Collection

ROAD THROUGH CAMBODIAN FOREST

In the distance are the smooth, bare trunks of the flamboyant tree, or "flame of the forest." Other trees of this region are the teak, dipterocarpus, kapok, sao, tamarind, etc. The bullock cart in the foreground is the kind in common use. In the trees alongside every road are hundreds of monkeys. These animals are never harassed by the Cambodians, who have an almost religious respect for them. The monkeys pay no attention to passersby.

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THE DANCES MOST POPULAR WITH THE KINGS OF CAMBODIA REPRESENT EPISODES IN THEIR HISTORY OR MYTHOLOGICAL SCENES FROM THE RAMAYANA

This picture represents the monkeys fighting the giant. Note the interested spectators in the background

Dieulefils Collection

DANCERS OF THE KING OF CAMBODIA PREPARING TO DANCE

The King of Cambodia at great expense maintains a large troop of dancers, as tradition requires the sovereign to maintain this evidence of his power and splendor. The dancers are chosen from the most beautiful women of the kingdom—those noted for their dexterity and grace, for the wealth of jewels which they can display, and for the richness of their dresses. Compare the bonnets to those on pages 240 and 240.

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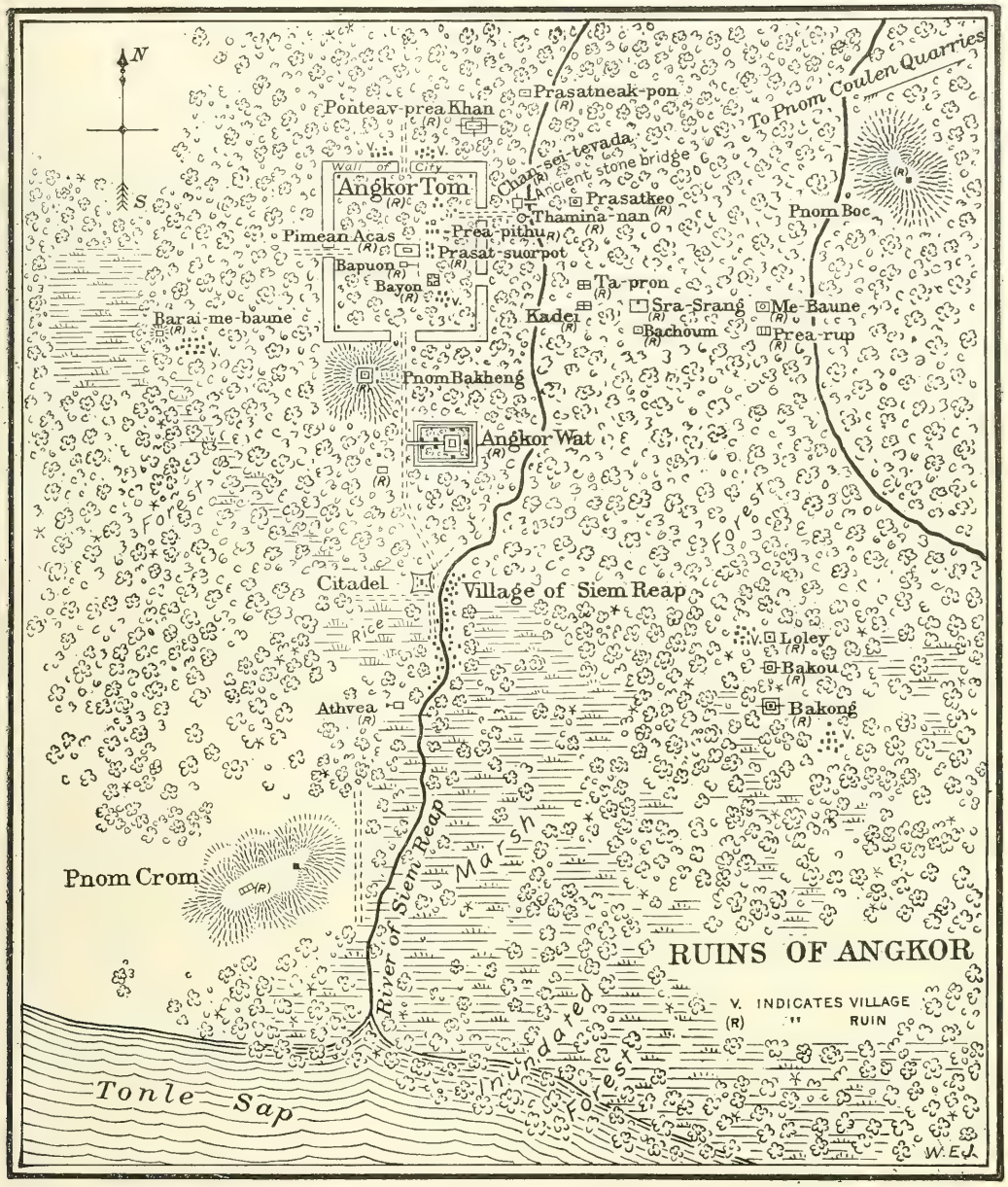
DANCERS OF THE KING IN THEIR FAVORITE ATTITUDE

Dieulefils Collection

BONZES (PRIESTS) VISITING THE VILLAGE TO RECEIVE ALMS

Every day the priests of the convent assemble and then visit the villages which support them. They are accompanied by the children of the most prominent men, who consider it an honor to wait upon the *bonzes* and to carry the basket in which the gifts, mainly rice, are deposited. All Cambodian boys must serve for a certain period, at least three months, in the convents of the *bonzes*.



OUTLINE MAP SHOWING RUINS OF ANGKOR: CAMBODIA

Angkor Tom, the capital city, and Angkor Wat, the temple, far outweigh in importance all the other ruins. However, at Loley, Me-Baune, Kompong-Chnang, Beng-Mealea, Bakong, and elsewhere there exist architectural and sculptural remains well worth noticing, as shown in a few illustrations herein presented. The writer desires to acknowledge his indebtedness for the illustrations almost wholly to two collections: Dieulefils, in which the architectural view predominates, and Fournereau, where decorative detail is best shown.

of, rasped against the sides of the sampan like a drowning thing struggling for the surface, and threatening to capsize the boat.

It was a scene of weird and fantastic beauty, with the triumph of the trees as its dominant note. With only a few short months during the dry season when they could be entirely above water, they were courageously invading the sea, adapting themselves to their novel situation and waiting for it to become dry land.

A BUDDHA WITH MANY ARMS AND AN UNUSUAL HEAD-DRESS: ANGKOR WAT

Dieulefils Collection

HEAD OF A GIANT WHO HAD MANY FACES

BUDDHA'S FOOT, AT ANGKOR WAT

THE NAGA, OR SEVEN-HEADED COBRA, THE FAVORITE DESIGN AT ANGKOR WAT

This is found in connection with practically all the ruins, usually as here, for a balustrade finial

Dieulefils Collection

THE APPROACH TO THE FRONT OF THE TEMPLE: ANGKOR WAT (SEE PAGE 228)

From the entrance a stone causeway leads up to this point, where the steps mount to the level of the outer gallery

And it will become dry land eventually. By daylight one can see for many miles the summit of Pnom Crom, situated on the very margin of the lake, utterly destitute of trees, its brown sides fissured with deep gullies and looking very much like an enormous sugar-loaf slowly dissolving. Looking about the country one may see other "pnoms," or eminences, likewise melting into the lake; so the day of the triumph of the trees is at hand.

These causes afford some solid basis of fact for the Cambodian fish stories, for the lake is undoubtedly a natural fish trap. As its waters recede, at the end of the dry season, the fish must needs crowd up into the shallow little streams that feed it. A few crumbs of bread thrown upon the water brought swarms of minnows around the sampan; but this also brought such grunts and whines of disapproval from the Cambodian oarsmen, to see good bread squandered on fishes, that the remainder of the loaf went to them.

They even laid aside their home-made cigarettes while they ravenously devoured the dry bread. I offered each of them a cigar with a colored paper label around it. The poor fellows removed their hats, tucked them under their arms, and advanced reverently with bowed heads and extended palms. Excess of gratitude could do no more.

It was broad daylight when I reached Siem Reap, after rowing and poling the boat for five hours through mud, water, and mosquitoes; then an hour and a half of jolting in a bullock cart, and there through the trees were the towers of the temple of Angkor Wat.

The first glimpse one gets of the ruins is when a rounded tower appears through the trees a mile or so distant, just a moment, and then no more till you are there. It is Angkor Wat, the most recent, the best preserved, the most classic and ornate of them all, though not the largest. There are many others scattered about this wide plain, including Angkor Tom, only a mile away; but these are all ruins, indeed, while the wat might still be called a building.

Standing in front of the temple grounds (the word *wat* means a temple), you see a moat some 30 rods wide surrounding the premises like a medieval castle, and crossed by a stone causeway leading to the main entrance. This entrance is itself a massive tower, flanked by two others only a little smaller, set in the inclosing wall. The whole inclosure is 800 by 1,000 meters, and its area is therefore 176 acres. Passing through the entrance, you see the elevated stone causeway, flanked by several small temples, leading up to the wat in the distance.

At a distance you get the effect of lateral magnitude only, for the entire structure or group of structures is sitting flat on a level plain, unaspiring and almost uninspiring. Had it been placed upon an eminence, and there is one not many rods away—but what's the use? The builders no doubt had their reasons, and they can't give them now.

It is not a little surprising, however, to look at the central tower and hear that it is actually 65 meters, 213 feet, from its summit to the level of the plain.

It is not till one enters the galleries and begins to measure distances relatively therefrom that the grandeur and impressiveness of the conception begins to make itself felt. Those same rounded towers now spring aloft, and the inner temple itself is raised above a surrounding gallery, which is in turn terraced above an outer and surrounding gallery, till the roof of the latter is on a level with the base of the former. These two encompassing galleries and the cruciform temple building proper within them are the main details in the ground plan of the wat.

The material used throughout in the construction is a grayish sandstone which the French call "grès." It much resembles marble in closeness and fineness of grain, and it stands weathering admirably. Where portions of the decorative detail had been affectionately caressed and stroked by admiring hands, the stone is as smooth as polished marble. The effect of the color is certainly as somber as could be conceived, and to see it in ruins is painfully suggestive of the grayness of death.

Dieulefils Collection

THE BEST VIEW OBTAINABLE OF THE CENTRAL TEMPLE OF ANGKOR WAT, SHOWING CENTRAL TOWER, 213 FEET HIGH, IN THE DISTANCE, AND THREE OF THE FOUR CORNER TOWERS

Inside and outside, and from top to bottom, it is a mass of carving (see page 247)

Dieulefils Collection

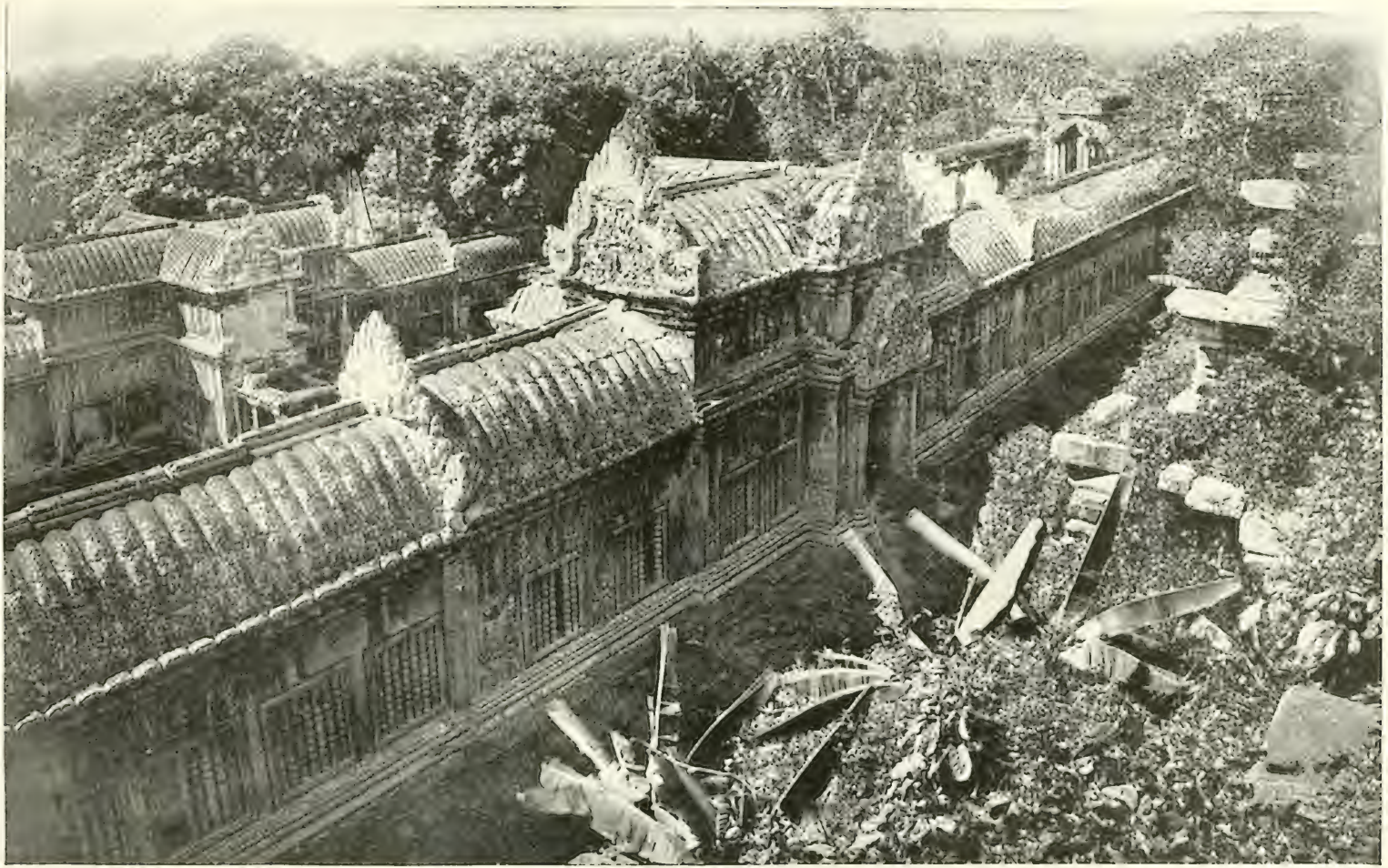
STAIRWAY LEADING TO THE SANCTUARY OF THE CENTRAL TOWER: ANGKOR WAT

It is twelve meters (40 feet) from bottom to top of stairway. The steps are unusually high and very narrow, so that climbing them is not only difficult but dangerous. Note the four carved figures in the left foreground and the delicate tracery carved above them. Almost every square foot, outside and inside, of this temple bears some exquisite design, carved in stone.

And all of these tons upon tons of stone were brought from Pnom Coulen, nearly 19 miles away. How, overland? Impossible. If that submerged forest could tell its own history we should probably hear of a time when both Pnom Coulen and Angkor were situated upon the margin of Tonle Sap and the stone-barges went to and fro between them. But that triumphant forest, having driven back the sea, has made a malarial marsh near the ruins which is simply one of its weapons offensive.

Cambodians, of course, can stand it, and the flimsy shacks of the bonzes are clustered about the base of the wat to-day, keeping up the tradition of its origin as a Buddhist monastery. The droning of their voices sounds almost constantly on the hot, drowsy air, as they read and study aloud.

It is little heed they pay to the ever-



Dieulefils Collection

VIEW TAKEN FROM AN ELEVATED POSITION ON THE BASE OF THE CENTRAL TEMPLE

This view shows the roofs of the surrounding galleries, south side; also the tropical vegetation that has not yet triumphed over these noble works of man (page 247). Groups of carved figures (indistinctly seen in the picture) decorate the spaces between the bars in the windows. Every

Dieulefils Collection

A CORNER OF THE SECOND GALLERY, SURMOUNTING A BASE SIX METERS HIGH

The rows of carved bars or columns conceal false windows, as the gallery is lighted from an interior court. The gallery contains numberless statues in stone or gilded wood, the better preserved of which still serve as objects of reverence to the faithful pilgrims. Note the four men in the right foreground and the rows of carved figures to their left.

Dieulefils Collection

DOORWAY OF THE SECOND GALLERY: ANGKOR WAT

Above are to be seen the coils of the naga (serpent) inclosing about fifty of the heroes of the Ramayana

Dieulefils Collection

SOME CAMBODIAN BONZES ON PILGRIMAGE TO THE GREAT TEMPLE OF ANGKOR WAT

They come in their long yellow robes from all Siam and Cambodia, and the monotonous droning of their voices as they read aloud increases rather than diminishes the lonesomeness of the place.

Dieulefils Collection

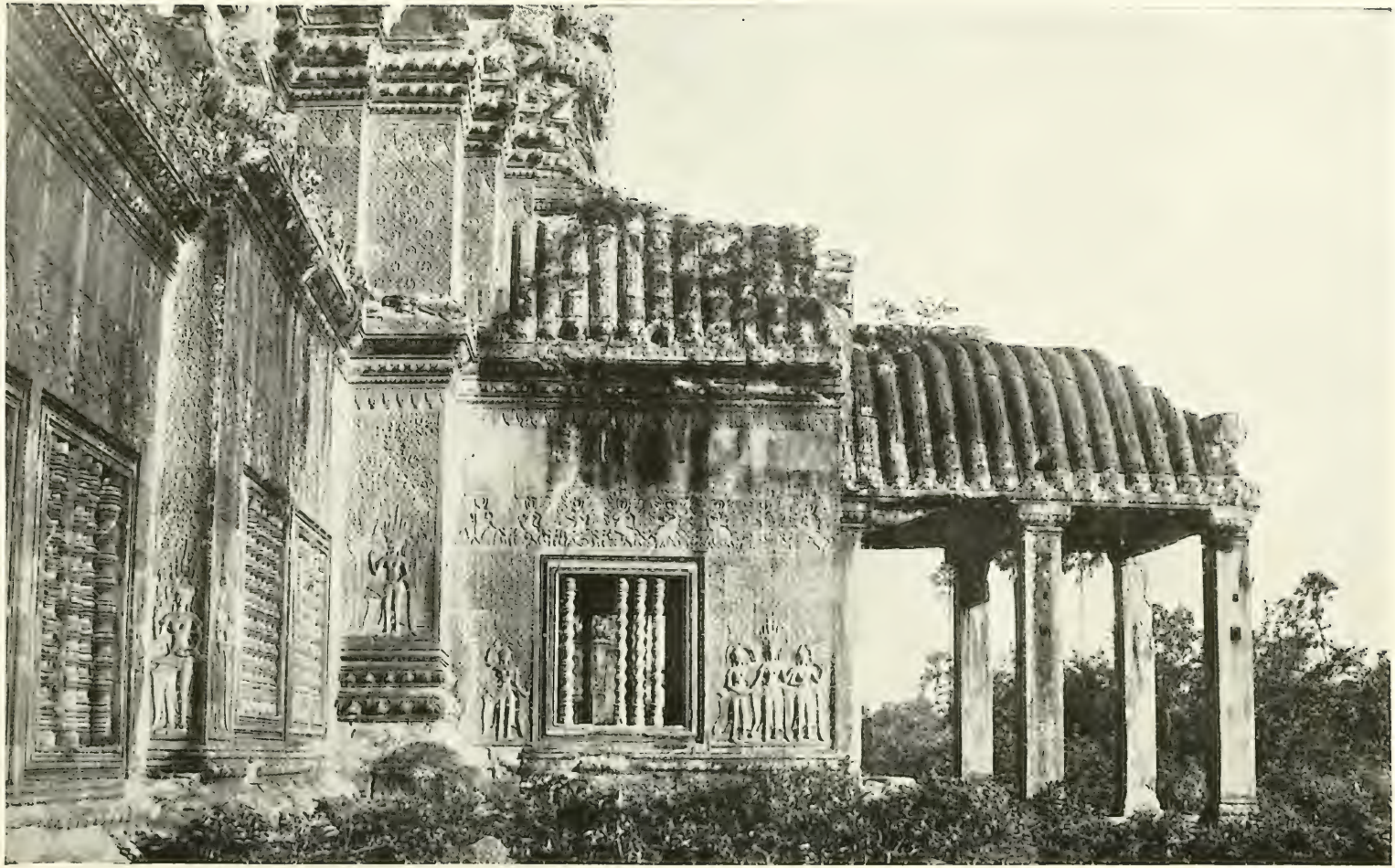
SMALL TEMPLE SITUATED INSIDE THE INNER GALLERY, BUT DISTINCT FROM THE MAIN TEMPLE

The roof of the inclosing gallery and the side of the great temple are shown. Outside of and below the gallery is the outer gallery. Each gallery is quadrilateral, surrounding the main temple, and its inner walls are covered with bas reliefs. Another view of this temple is shown on page 237.

Dieulefils Collection

ANOTHER VIEW OF THE SMALL TEMPLE

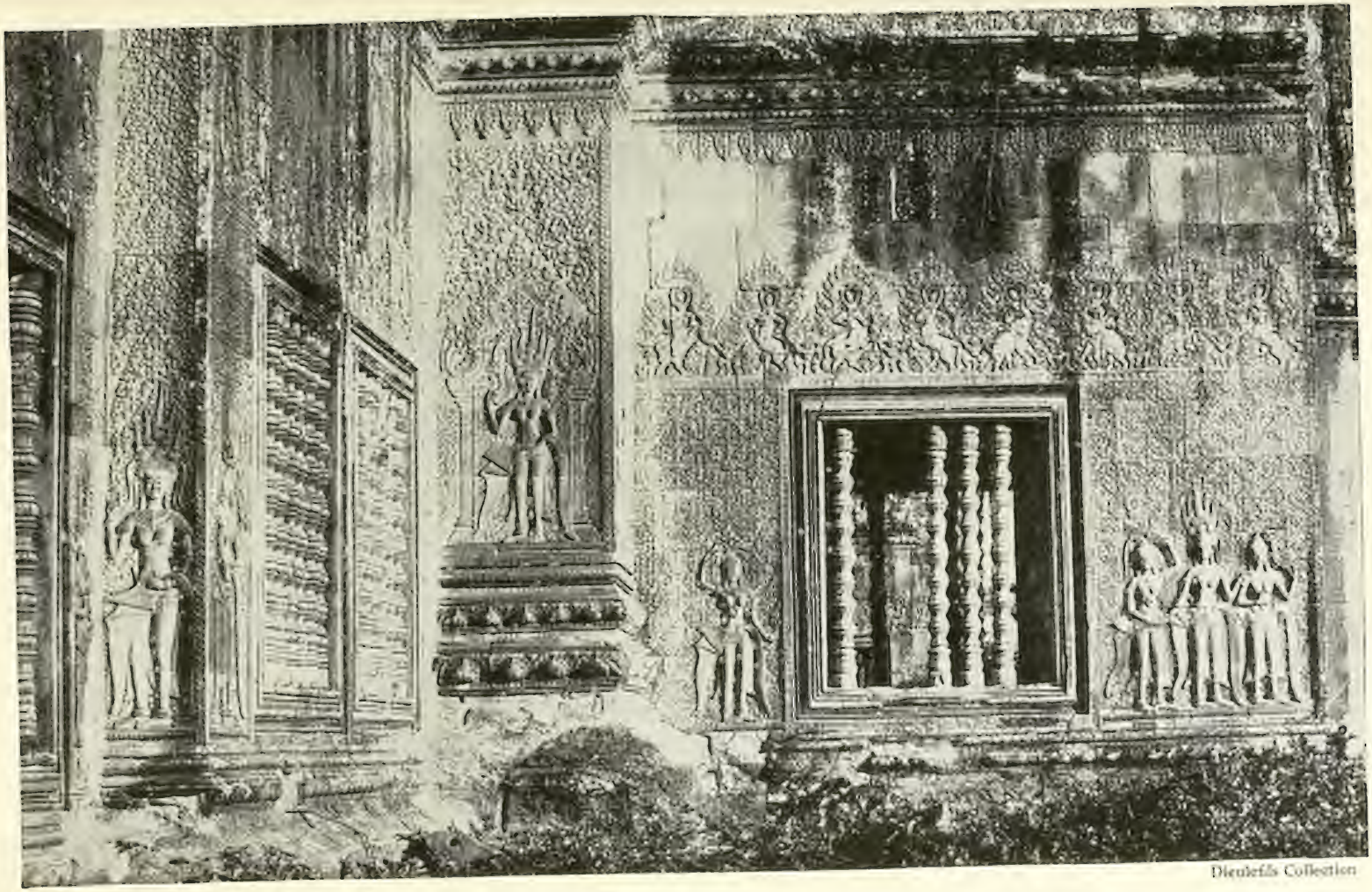
Note the richness of carving extending to the very top of the building



Dieulefils Collection

PORTICO AND PERISTYLE OF THE CENTRAL TOWER: ANGKOR WAT

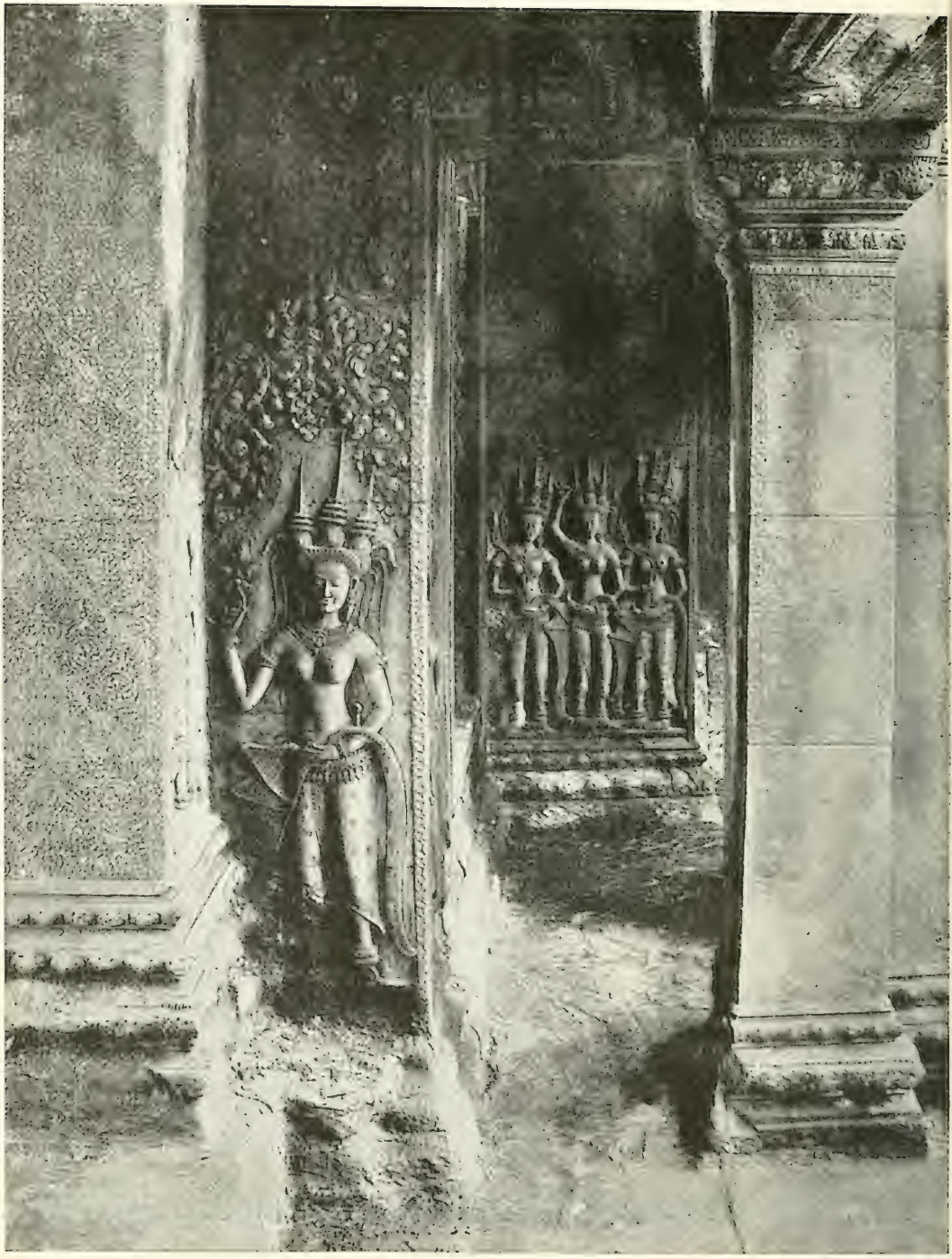
It is remarkable that this lavish decoration has so well withstood the weathering of the torrential rains for something like eight hundred years. From end to end the walls of the galleries are covered with these marvelous friezes.



Dieulefils Collection

DETAIL OF THE PRECEDING VIEW FROM A DIFFERENT ANGLE

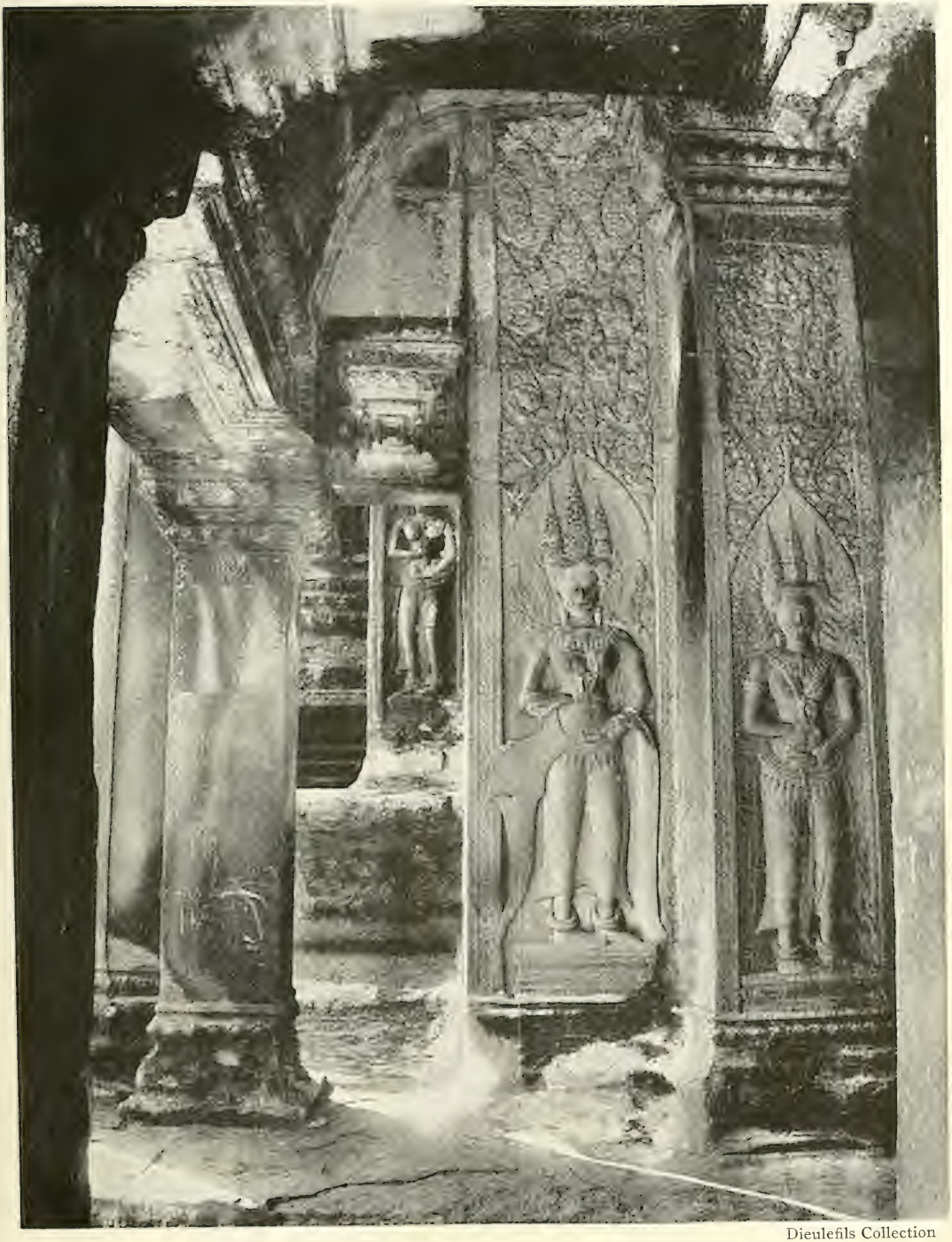
The bars in the windows appear to be a conventionalized abacus or counting frame, such as one sees in all the Orient. They are made of the same gray stone used throughout in the structure of the temple. Note the warriors astride horses, elephants, etc. (see pages 246 and 247)



Dieulefils Collection

PILASTERS, DEMI-VAULT, AND LINTEL, ALL SHOWING THE USUAL WEALTH OF CARVED STONE: ANGKOR WAT

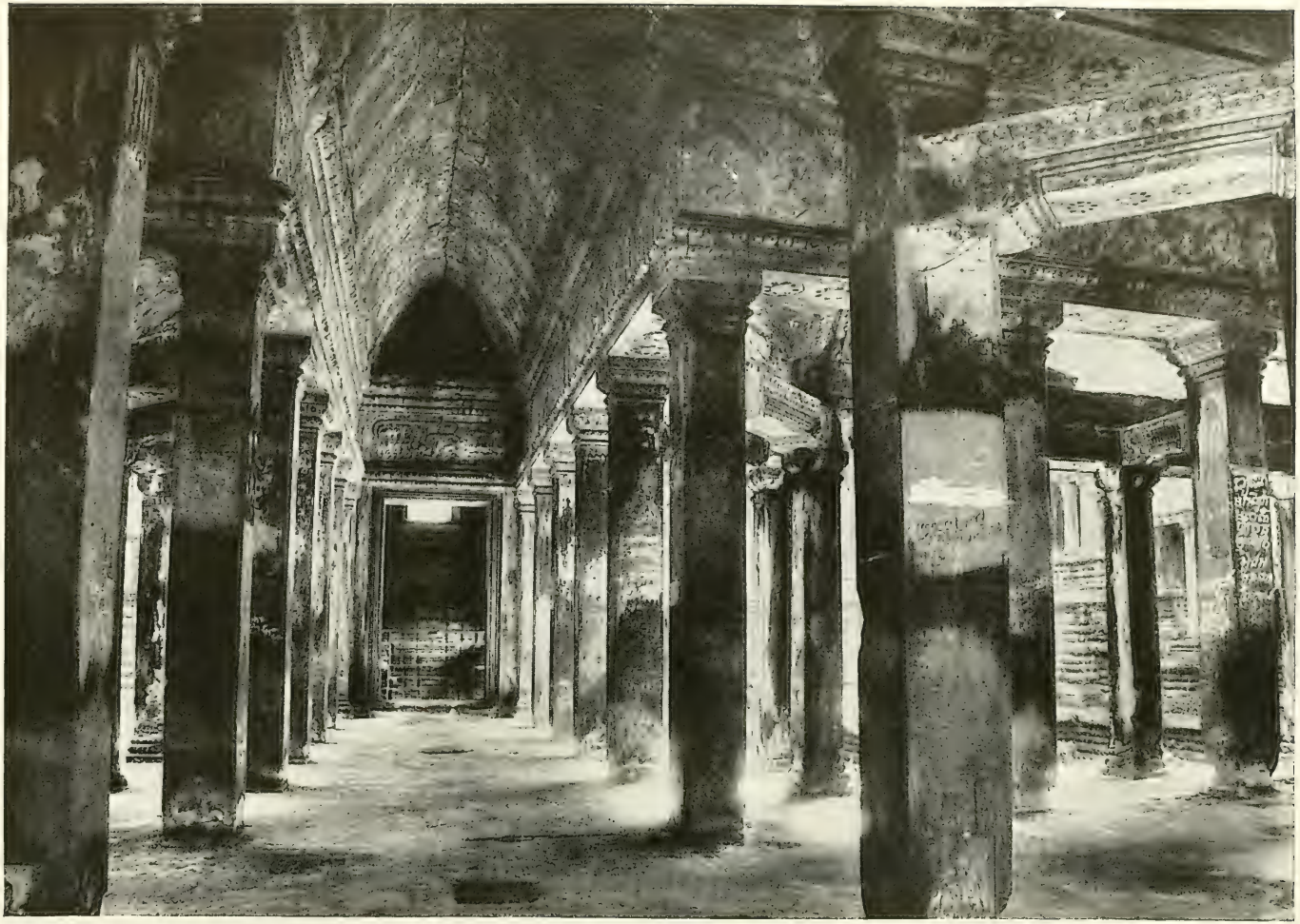
Every foot of the outer and inner walls of the galleries on every floor are richly decorated. Divine figures or *tevadas* abound. Most of these feminine figures are of superb expression and grace. Their rich head-dress is ornamented with jewels, the neck is decorated with necklaces, and the arms and ankles ornamented with richly carved bracelets. Many of the images are polished with the touch of generations of pilgrims (see also page 249)



Dieulefils Collection

THE SAME KIND OF SITUATION SIMILARLY TREATED

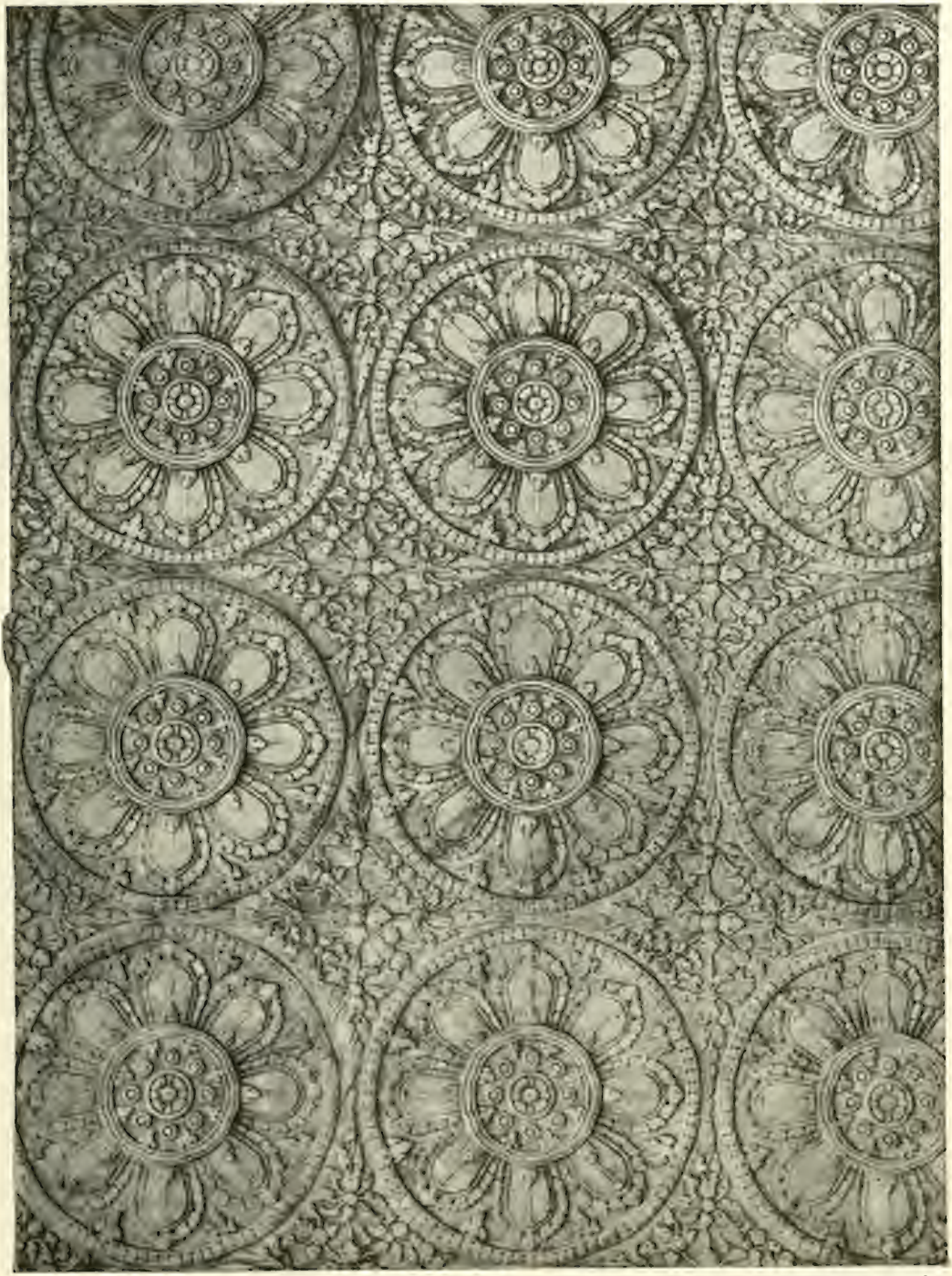
The gates to the cloister in the central tower, where the Buddhist divinities are invoked every day, are decorated with pilasters, richly carved. Divine persons, the *tevadas,* carrying in their hands the lotus flower, are the most common images (see also page 249)



Dieulefils Collection

INTERIOR VIEW OF THE CRUCIFORM GALLERY, IN THE CENTRAL TEMPLE

All the columns shown in the illustration are monoliths, their bases being decorated with figures of old men, finely sculptured see page 246). Above the handsomely carved cornices are friezes of dancing women (see pages 244 and 245). The corbel arch was originally hidden from view by delicately carved wooden paneling, of which a portion may be seen in upper right corner (see page 243).



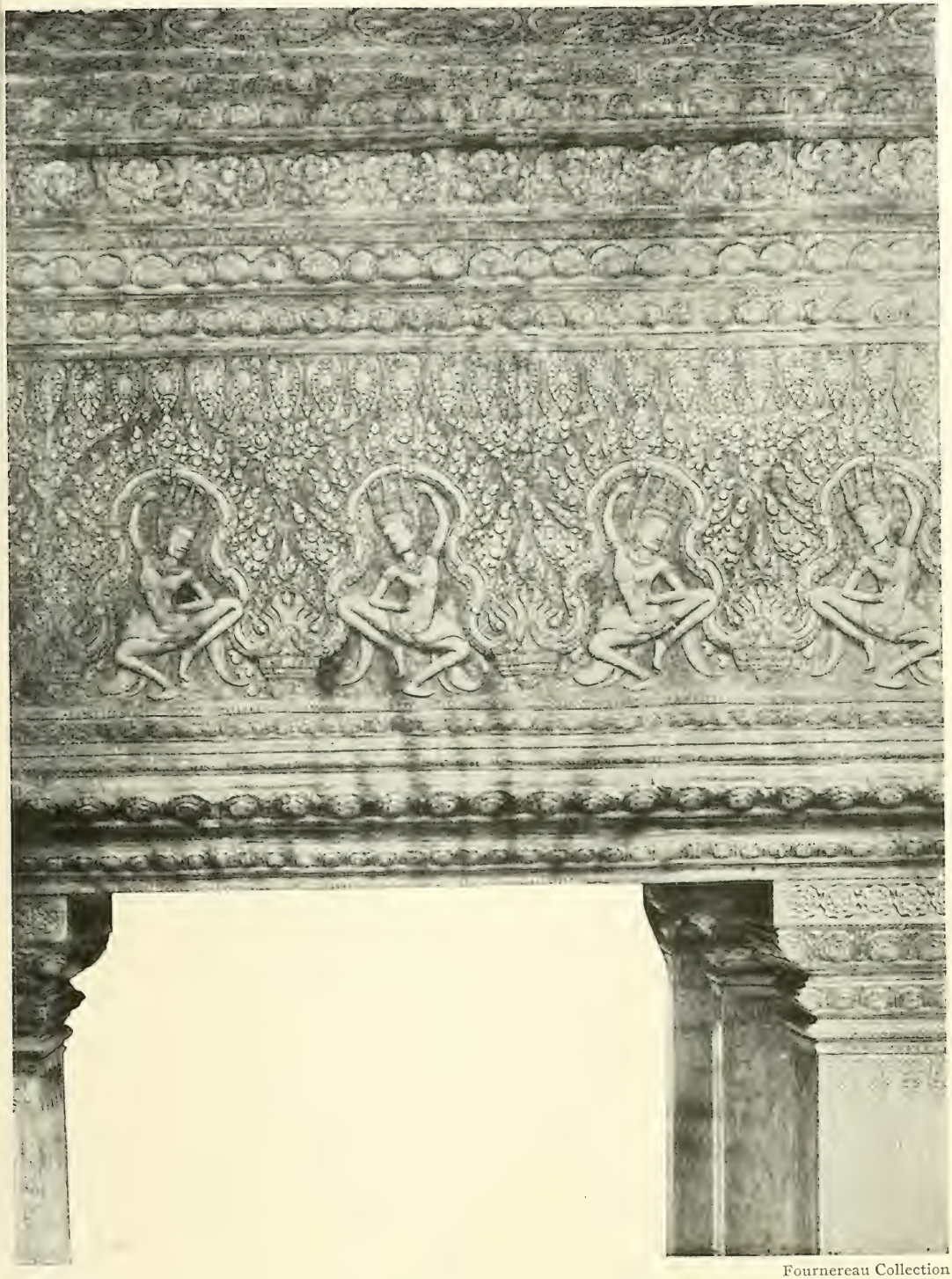
Fournereau Collection

A PORTION OF THE CARVED WOODEN CEILING OF THE GALLERIES

Its principal purpose was to conceal the corbel arch, which was not intended to be ornamental. Only a few pieces of this ceiling remain

THE HEAVENLY DANCERS: ANGKOR WAT

These designs occur frequently in the ornamentations of the temple. Ballet dancing is evidently not a modern art. The Cambodian court of the present day has its corps of ballet dancers who are said to preserve some of these ancient dances (see pages 222 and 223)



Fournereau Collection

ENTABLATURE IN THE CRUCIFORM GALLERY OF THE TEMPLE AT ANGKOR WAT, SHOWING THE FAMILIAR "HEAVENLY DANCERS," THE RICH DECORATIONS ABOVE, AND A PORTION OF THE WOODEN CEILING (SEE PAGE 243)

Fournereau Collection

PORTION OF A FRIEZE AT ANGKOR WAT, SHOWING A WARRIOR ASTRIDE A DRAGON

Fournereau Collection

DECORATION AT BASE OF THE PILLARS SUPPORTING THE GALLERIES

There are hundreds of these square pillars, the faces being decorated at the base just like the one above, and from the top downward with lace-work design (see page 242).

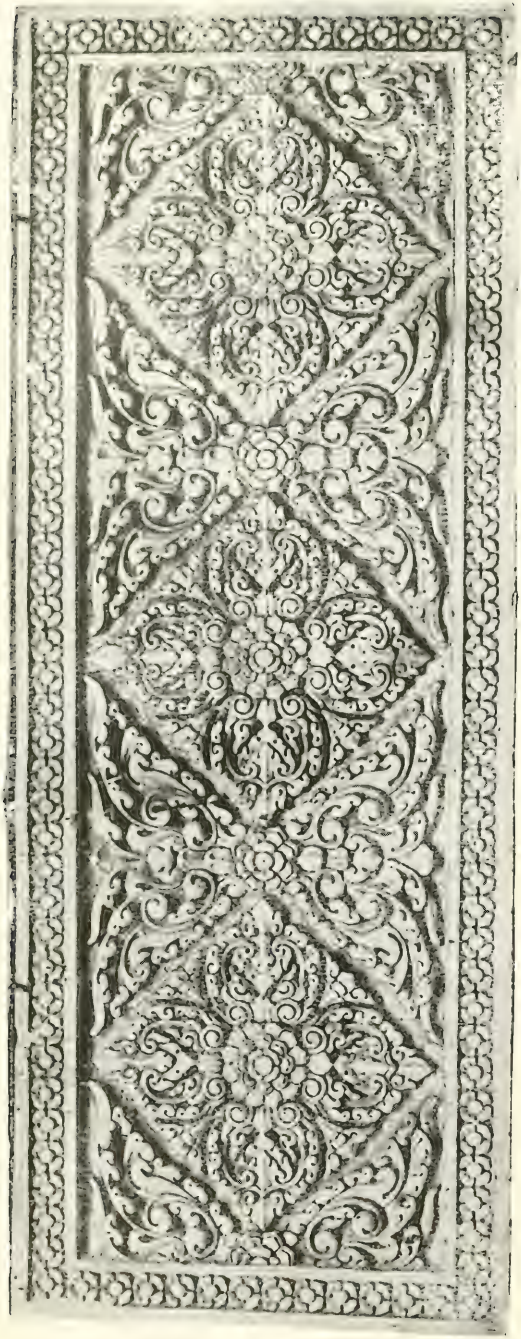
Fournereau Collection

ANOTHER PORTION OF THE FRIEZE IN THE SAME TEMPLE: ANGKOR WAT

wakeful plants, the grasses, shrubs, and trees that are constantly at work prying at the foundation stones and swaying the columns. Already there are piles of broken stone at the base of the walls, like the talus at the foot of a cliff, the outer decorations and unessential parts. The halls and corridors are in the main intact and need little more than cleaning to be made habitable. No wonder that with only the bonzes to look after the wat it has long ago been given up to bats and pigeons and filth—and silence. It is a silence so lonesome and deathlike in its isolation that one shudders in turning a corner to find himself confronted by a stony Buddha with uplifted hands, as if imploring him not to disturb the repose of the centuries.

If the mass of the structure is impressive, the amount of decorative work done upon it, to speak only quantitatively, is still more so. Inside and outside, and from top to bottom, it is a mass of carving in stone. A few blank spaces are to be found about the building, and these are generally in the main temple, reserved for the work of the greater artists who never came. Both the encircling galleries consist of a row of square columns on the outer side, an arch *en corbeille* above, and an inner wall with an entablature for the whole colonnade. And everything is decorated—the four flat faces of the columns, the walls, the entablature, and the wooden ceiling which formerly rested upon it, concealing the arch which is unornamented.

Around the base of the structure is a colonnade of clustered columns, which may have been added as an afterthought some centuries later. These much resemble the clustered columns of Moorish architecture, except that the channeling is not deep; and, furthermore, the capital much resembles the Byzantine. But for the rest, you see the square column everywhere, the same dimensions from top to bottom; long rows of them in the galleries, a cruciform colonnade of them on the terrace, or modified into pilasters when adjacent to doorways.



Fournereau Collection

JUST A PIECE OF STONE TRACERY AT ANGKOR THOM

FRAGMENT OF ONE OF THE ANGLES OF A LITTLE TOWER AT PIMEAN-ACAS

In the picture on the right, as in all of the work of these people, the treatment of the human form is much inferior to that of the ornamental detail to be seen on every side

The best specimens of the decorative art of Angkor are to be found upon these columns, especially those in the form of pilasters with the lintel above them. Indeed, it is doubtful if at its best it can be surpassed—let us say *often* surpassed, to be very careful—by the best that can be shown from classic remains. Just a few inches from the bottom is usually to be found a bearded Buddha, and above, a tracery in stone, the pattern of which is as delicate and graceful as fine embroidery.

The grotesque is sometimes employed on the exterior in the form of a modified façade, or pediment, over an entrance, the motif being sometimes a dancing figure, or more often an entanglement of monkeys. It is to be remembered that these decorative designs literally "crowd the canvas," with an evident purpose to leave no visible space unadorned. True, many of the designs are repeated over and over, but the number and variety are nevertheless amazing.

Probably the most interesting of all the decorations is the several series of bas-reliefs, which are first in the matter of quantity. Here is a partial summary of the processional bas-reliefs of this one structure:

1. Battle between men and monkeys—a favorite theme—160 feet long.

2. Battle between Hindus and unknown enemies, 160 feet long.

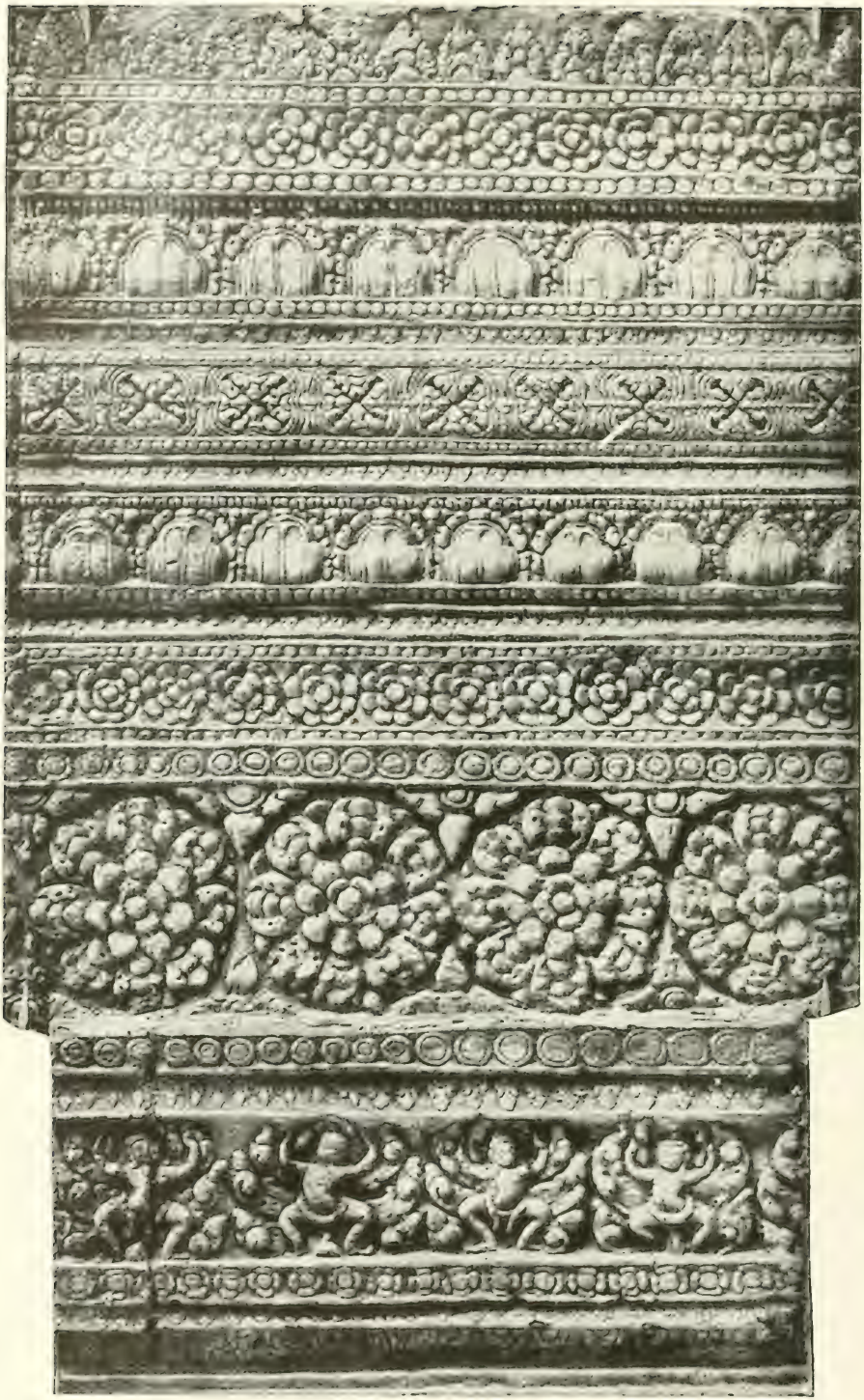
3. Hunting procession, 324 feet long.

4. Three more battle processionals, 171, 219, and 300 feet, respectively.

Fournereau Collection

A QUEEN WITH FIVE TIARAS: WALL DECORATION IN THE CENTRAL TOWER: ANGKOR WAT

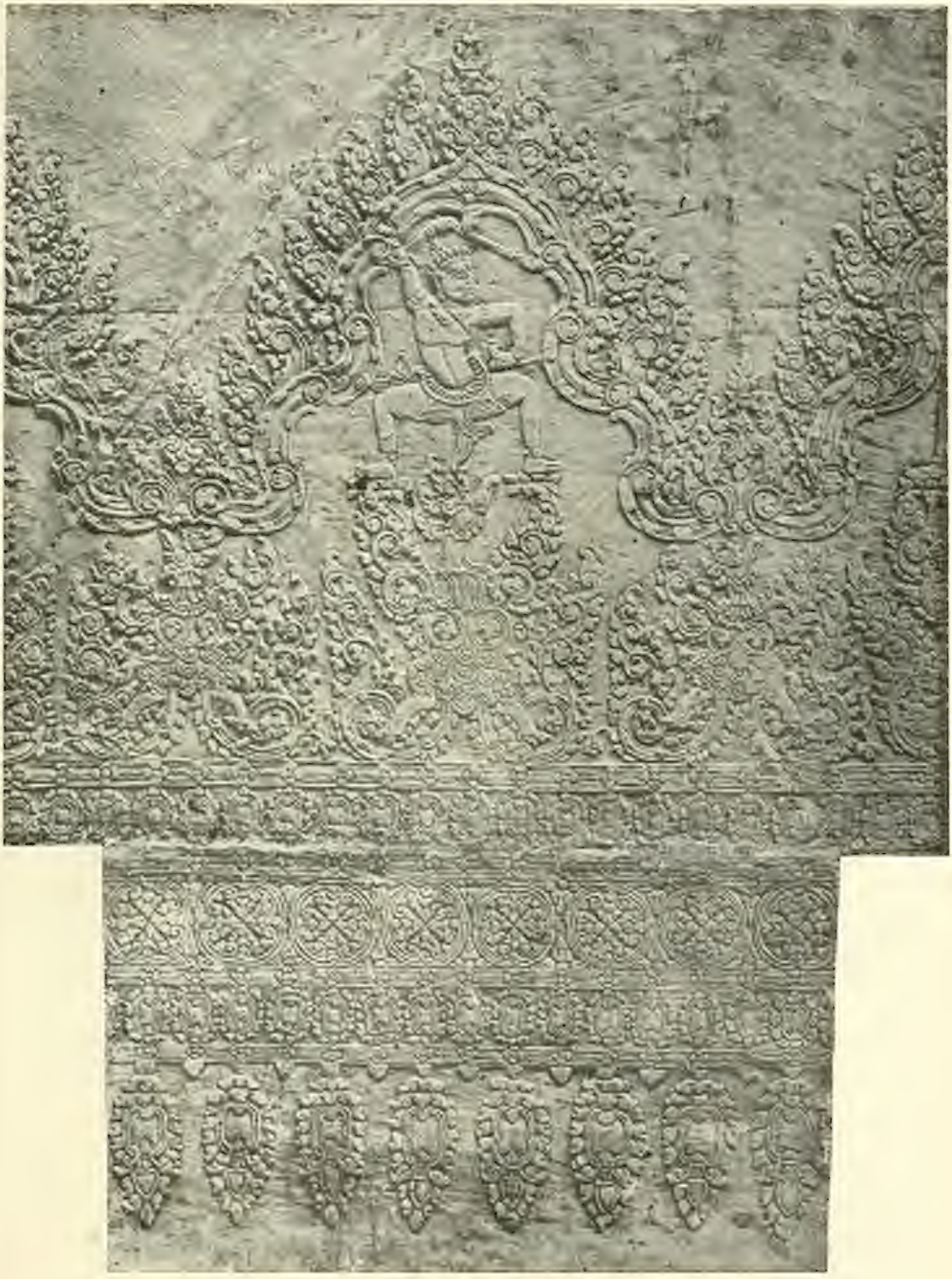
These are the principal decorative figures in the most conspicuous parts of the temple. The feet had to be put on somehow, so the sculptor turned them sideways (see page 240).



Fournereau Collection

A PORTION OF THE ENTABLATURE IN THE TEMPLE AT ANGKOR WAT, SHOWING GREAT RICHNESS OF ORNAMENTAL DETAIL

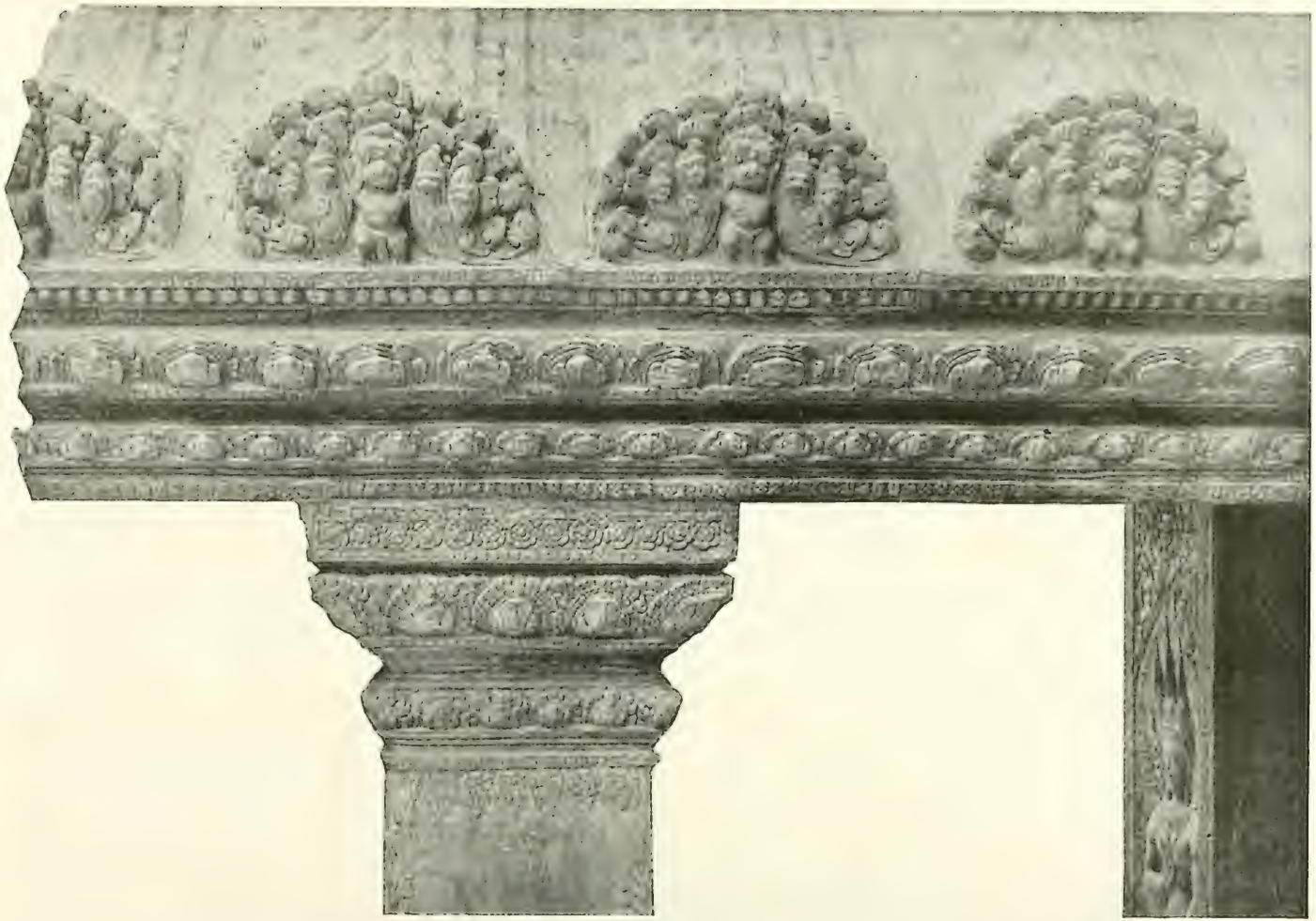
There are seven bands of designs separated by narrow ribbons scarcely less ornamental. These bands appear to be conventional yellow pond lilies, which abound in that locality, and two are lotus-leaf designs, all carved in stone.



Fournereau Collection

A BEAUTIFUL PIECE OF LACEWORK IN STONE

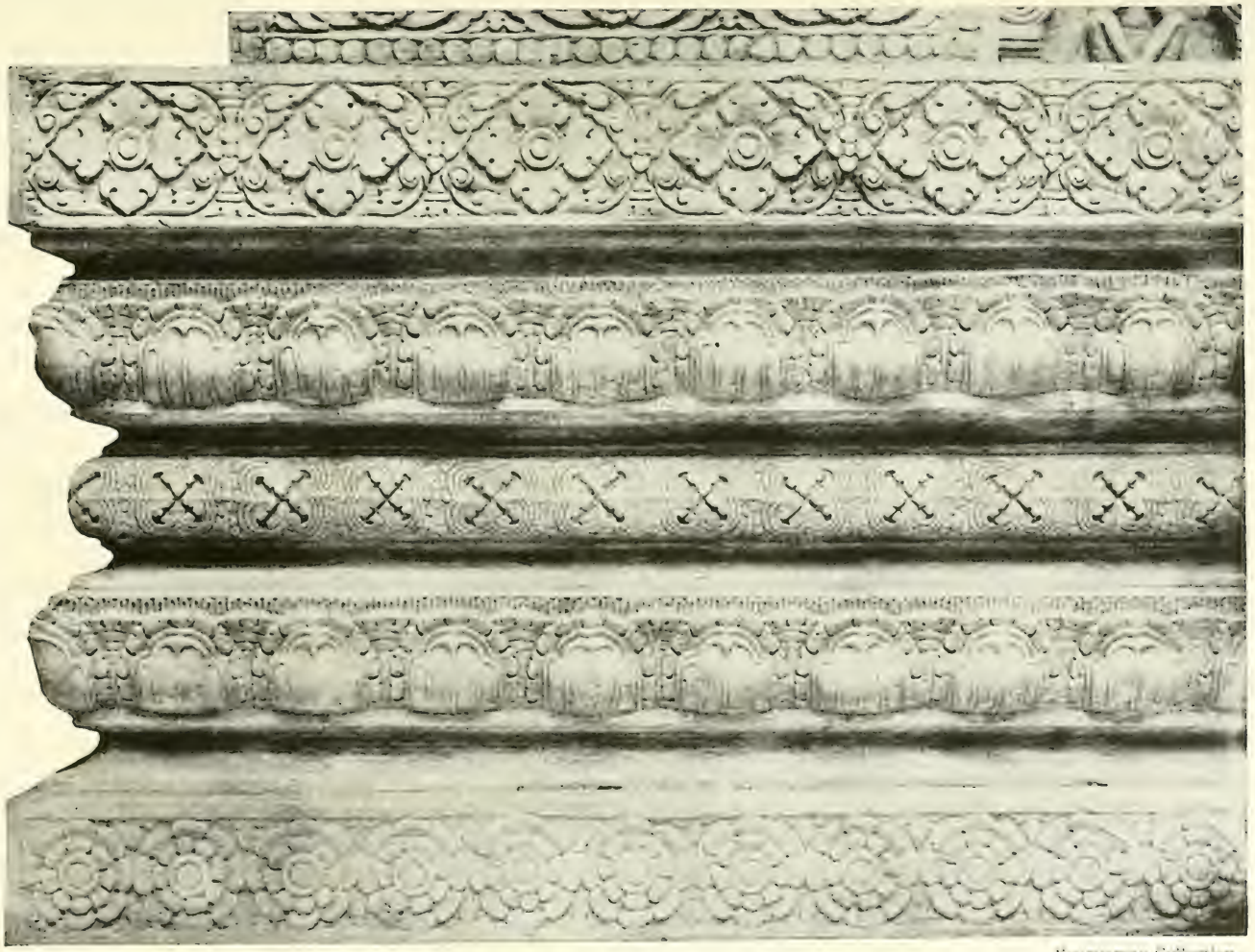
A part of the entablature, with the top of the supporting pillar, in the gallery of the central tower. The grotesqueness of the dragon heads, refined and interwoven with the finer lines, is characteristic of the whole work.



Fournereau Collection

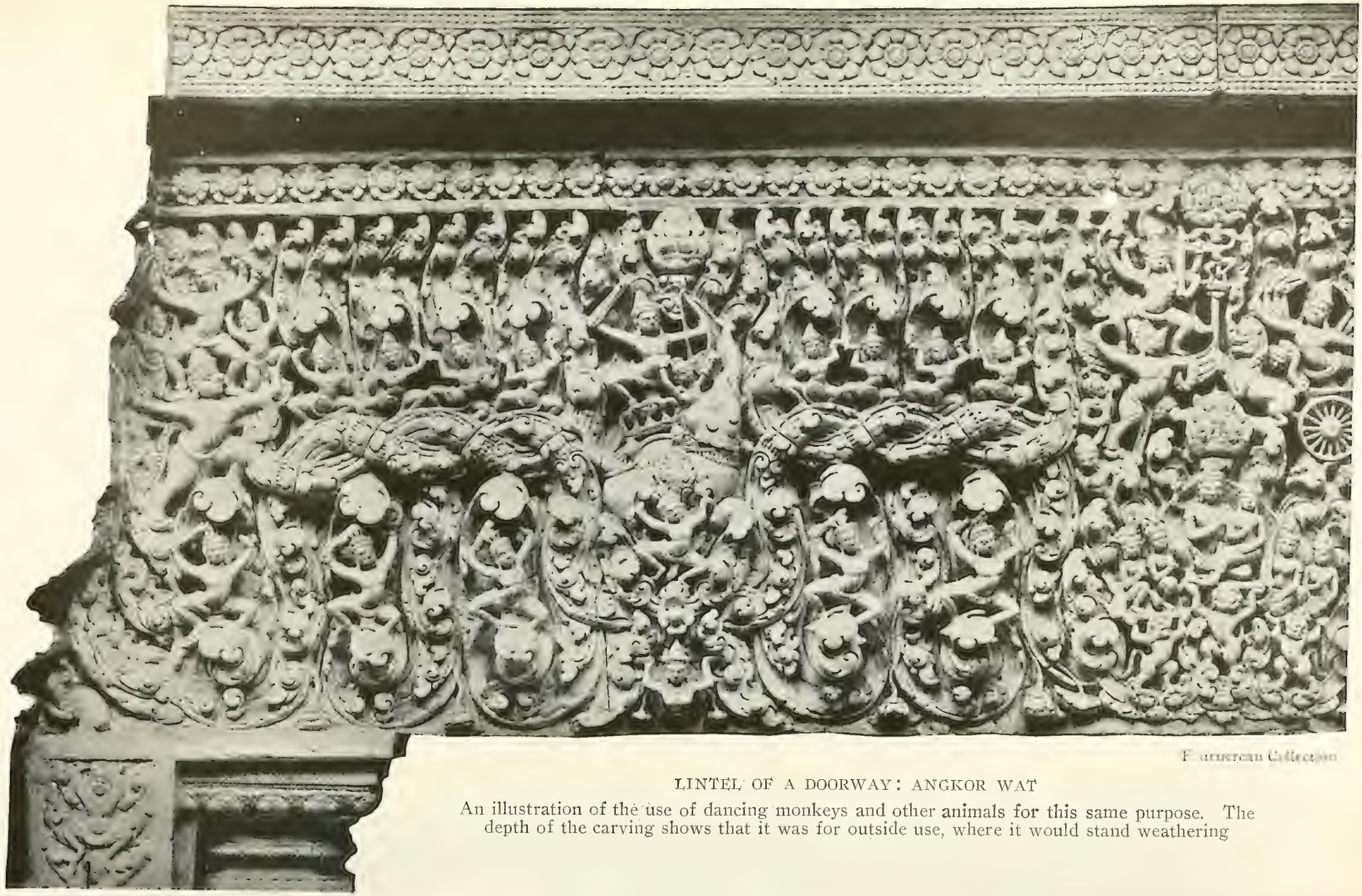
PORTION OF THE ROOF OF THE GALLERY SURROUNDING THE MAIN TEMPLE: ANGKOR WAT

Note how even the top of the roof is ornamented. The roof, to be sure, was in plain sight from the inclosed temple



Fourmeraux Collection

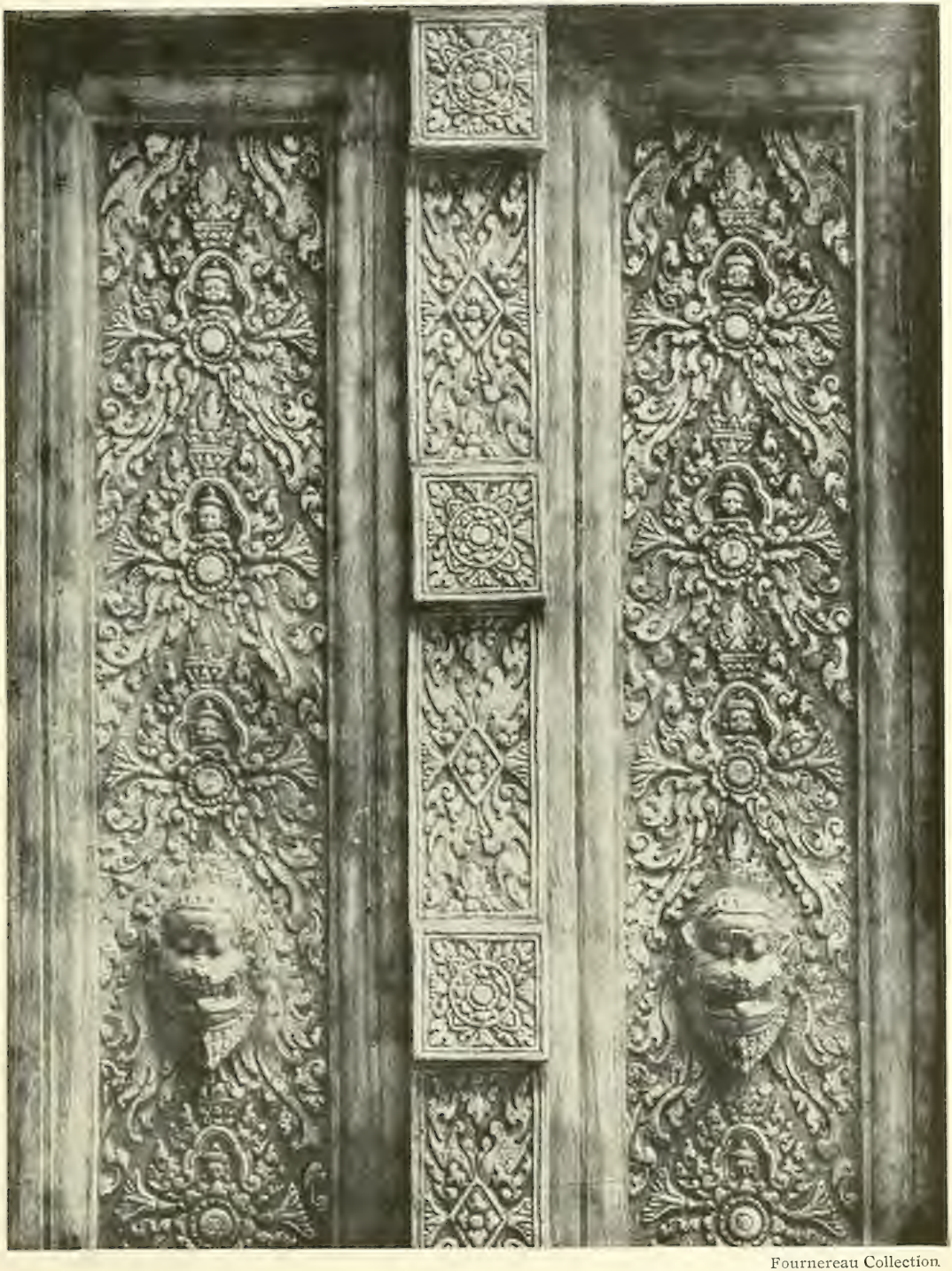
At Angkor Wat the exterior stairways and balustrades are usually treated with this great variety of decorative detail



Fournereau Collection

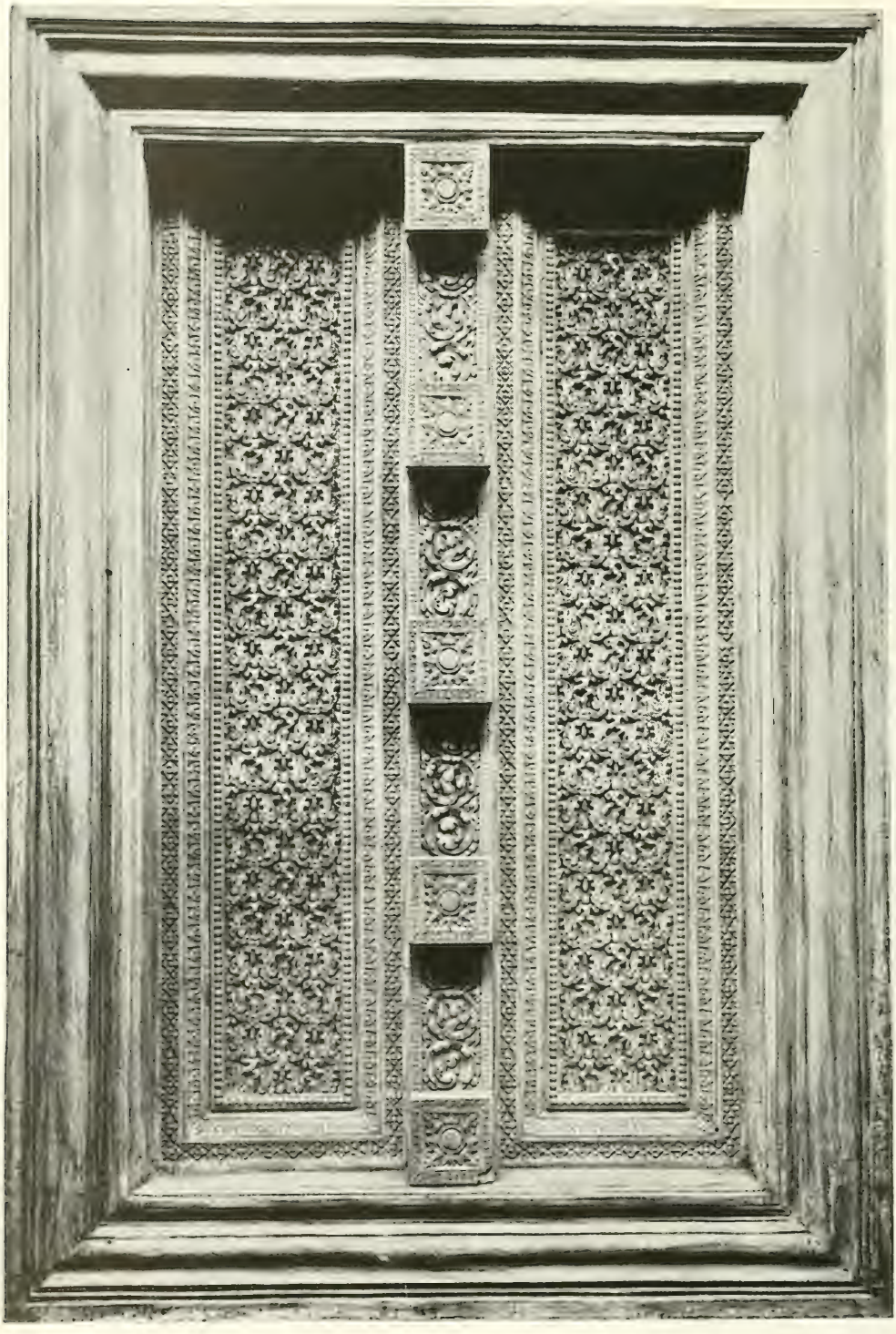
LINTEL OF A DOORWAY: ANGKOR WAT

An illustration of the use of dancing monkeys and other animals for this same purpose. The depth of the carving shows that it was for outside use, where it would stand weathering



Fournereau Collection.

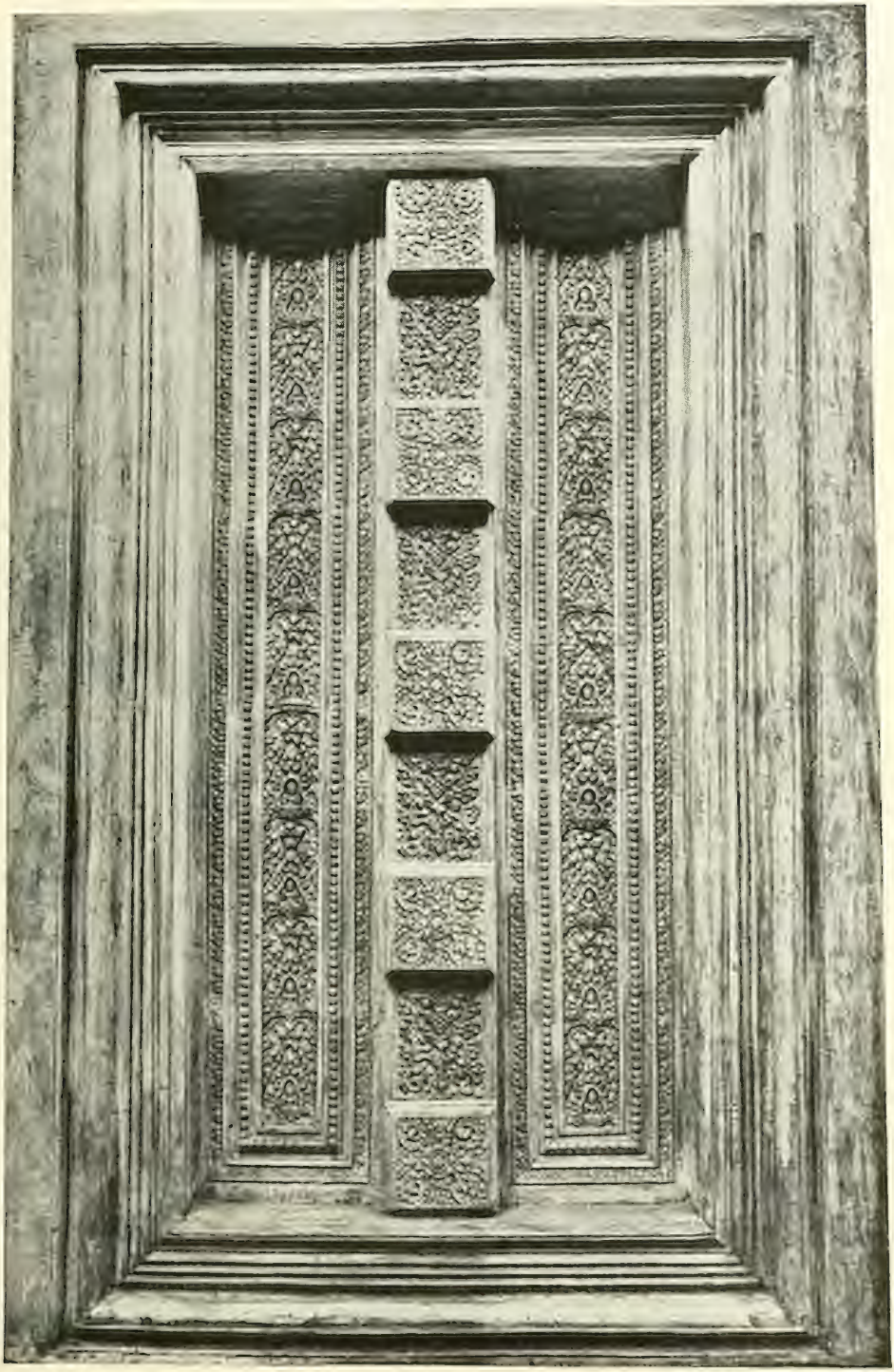
FALSE DOOR IN ONE OF THE TOWERS AT BAKONG, CARVED IN STONE



Fournereau Collection

FALSE DOOR AT LOLEY, IN ONE OF THE TOWERS

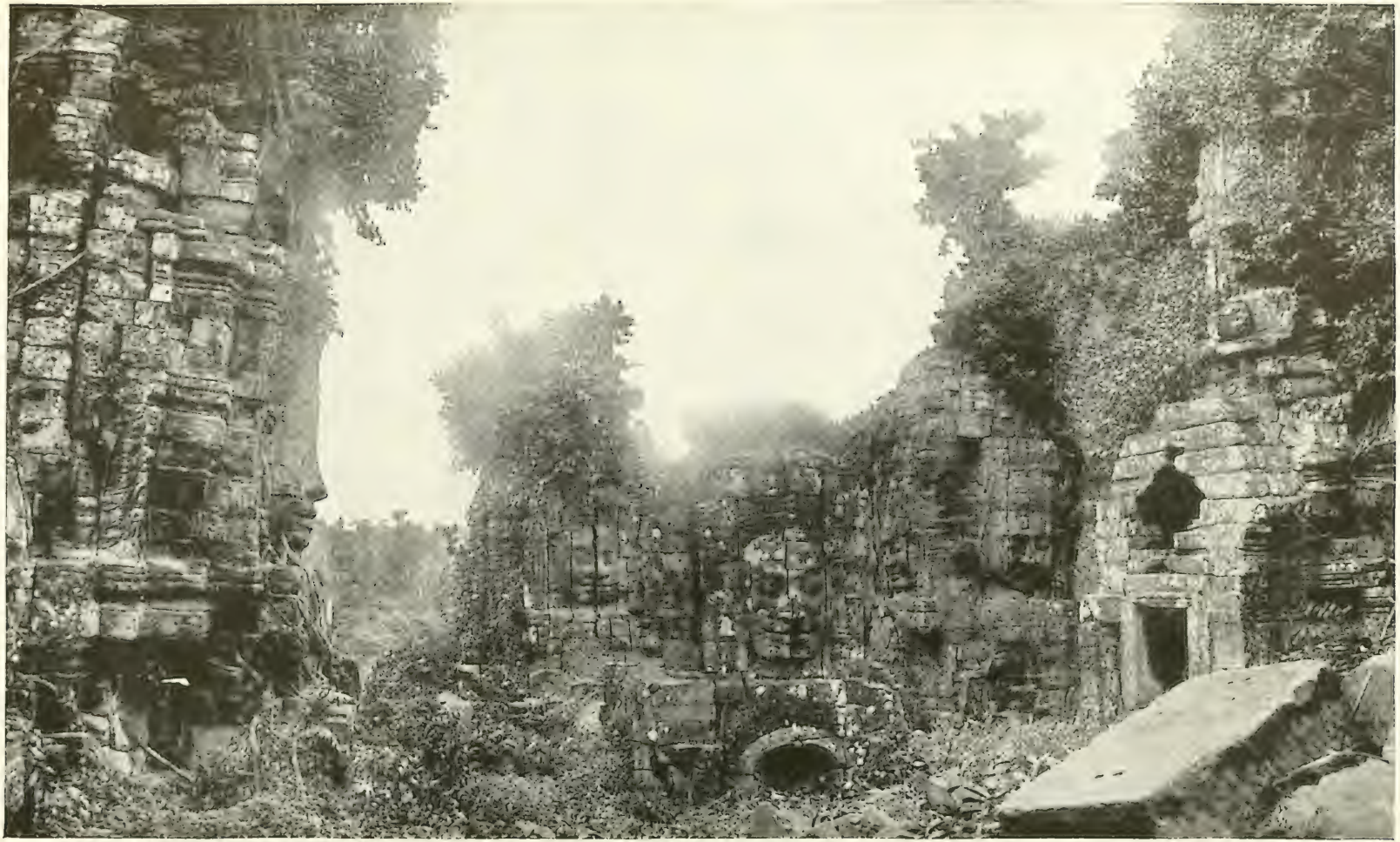
This is not lace, but carved stone. No finer example of Khmer workmanship can be found than these so-called "false-doors." Count the figures



Fournereau Collection

ONE OF THE FALSE DOORS IN THE TOWER AT ME-BAUNE, WITH REMARKABLY BEAUTIFUL TRACERY IN STONE

Evidently the false door was intended only for decorative purposes. There are many of these exquisite false doors in the various ruins of Cambodia (see map, page 225), but none at Angkor, as they probably belong to a later and more refined age than that which saw the Bayon, or even the Wat, erected.



Fournereau Collection

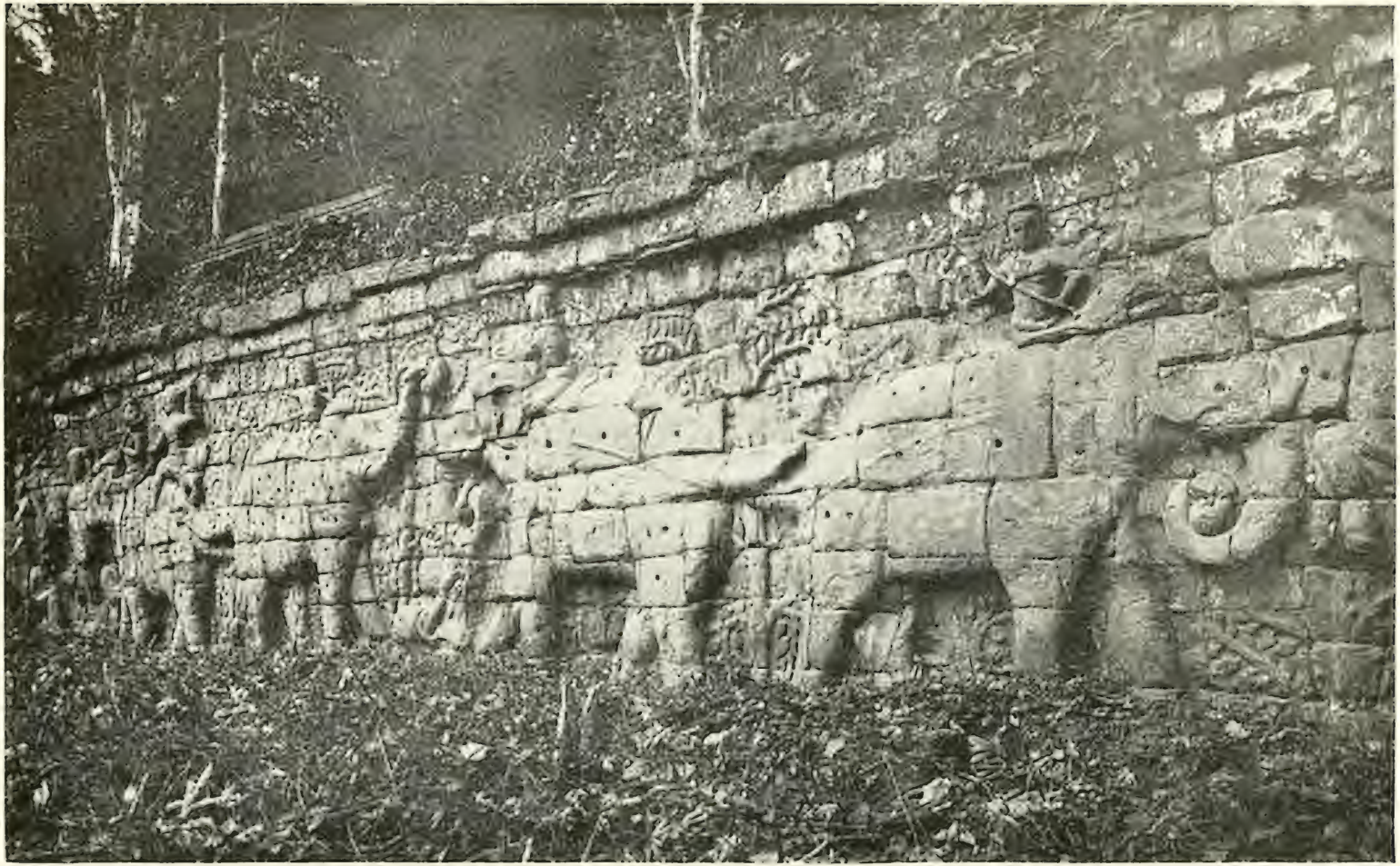
PART OF RUINS OF BAYON, THE MOST IMPORTANT RUIN AT ANGKOR THOM

Puzzle picture: how many Buddhas' faces can you find? Angkor Thom covered an area 10 times greater than Angkor Wat. It was built some 300 years before the latter and is now a complete ruin

Fournereau Collection

ONE OF THE FIFTY-THREE TOWERS IN THE STRUCTURE KNOWN AS THE BAYON

Showing the enormous Buddha faces looking toward the four cardinal points of the compass. Not only in the 53 towers, but in many other parts of this ruin, these same faces are found. Every one of the 53 towers had four of these faces (see page 271 and map, page 225).

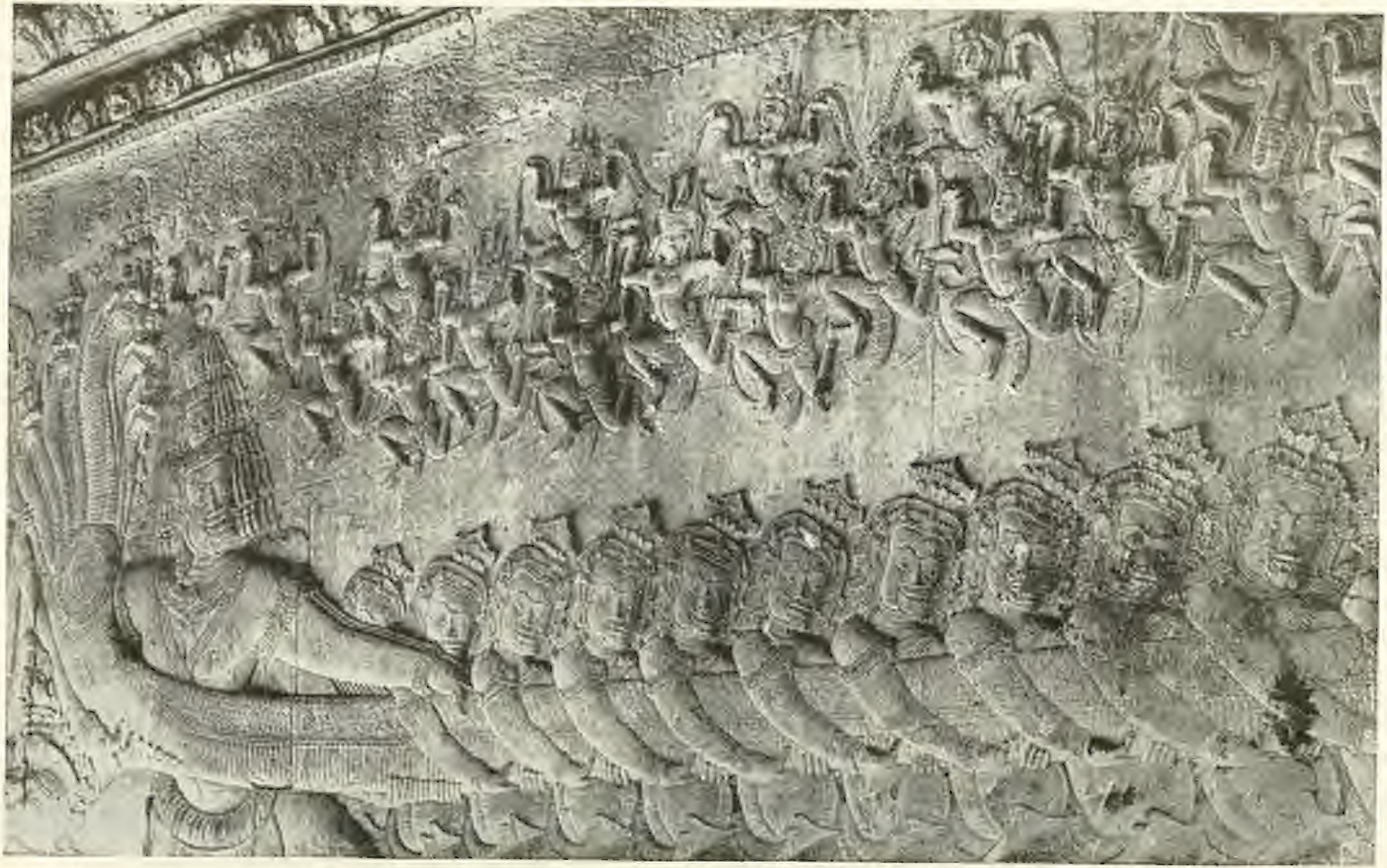


PROCESSION OF ELEPHANTS ON THE WALL OF THE GRAND TERRACE: ANGKOR THOM
The holes show that they were formerly covered with trappings

Fournereau Collection

MASSIVE PORTAL: PART OF RUINS AT KOMPONG-CHNANG ON THE MEKONG

One of the many places about the plains of Cambodia where the Khmers left their mark



PROCESSION BRINGING THE NAGA, OR SEVEN-HEADED COBRA: ANGKOR WAT (SEE PAGE 267)

Fournereau Collection

PORTION OF ONE OF THE BAS-RELIEFS REPRESENTING A PRINCE IN HIS HOUSE SURROUNDED BY WOMEN: ANGKOR WAT

Just below this bas-relief is one showing in a long series of illustrations the different kinds of punishment inflicted. They are gruesome enough to satisfy the most cruel disposition (see page 271).

Fournereau Collection

ANOTHER OF THE BAS-RELIEFS OF ANGKOR WAT, SHOWING THE ROYAL BARK

In the bow are the musicians and dancers; under the canopy the royal family beguiles the time; in the stern the domestics are enjoying a cock-fight, just as they do now, while below the slaves are tugging at the oars through a sea crowded with fish

Fenwerolan Collection

PORTION OF THE BAS RELIEFS OF THE SOUTHWEST GALLERY, SHOWING AN EPISODE IN THE COMBAT BETWEEN PANDAVAS AND KAURAVAS (MAHABHARATA); ANGKOR WAT

The recumbent figure is not supported by spears, but is falling pierced by arrows. The figures below are holding long-handled fans of lotus-leaf design

Fourcaveau Collection

PART OF THE HUNTING PROCESSION, 324 FEET LONG: ANGKOR WAT

Note the conventionalized tropical forest, the umbrellas shading the royal hunter, and the feet of the pedestrians. This is but one of the many scenes represented in this bas-relief, considerable variety being introduced in the main features where variety was possible. The line of footmen stretches out interminably. The part here shown is about 10 feet long and 8 feet high. This one panorama

Fournereau Collection

EXPLOIT OF HANAMUNT, KING OF THE MONKEYS: ANGKOR WAT

By means of his great strength he is able to seize two dragons, holding them in a position where they are powerless, and strangle them by wrapping his legs around them

5. Procession of the 7-headed snake, Naga, 126 feet long.

6. Procession of Paradise and Purgatory; length undetermined; at least 160 feet long.

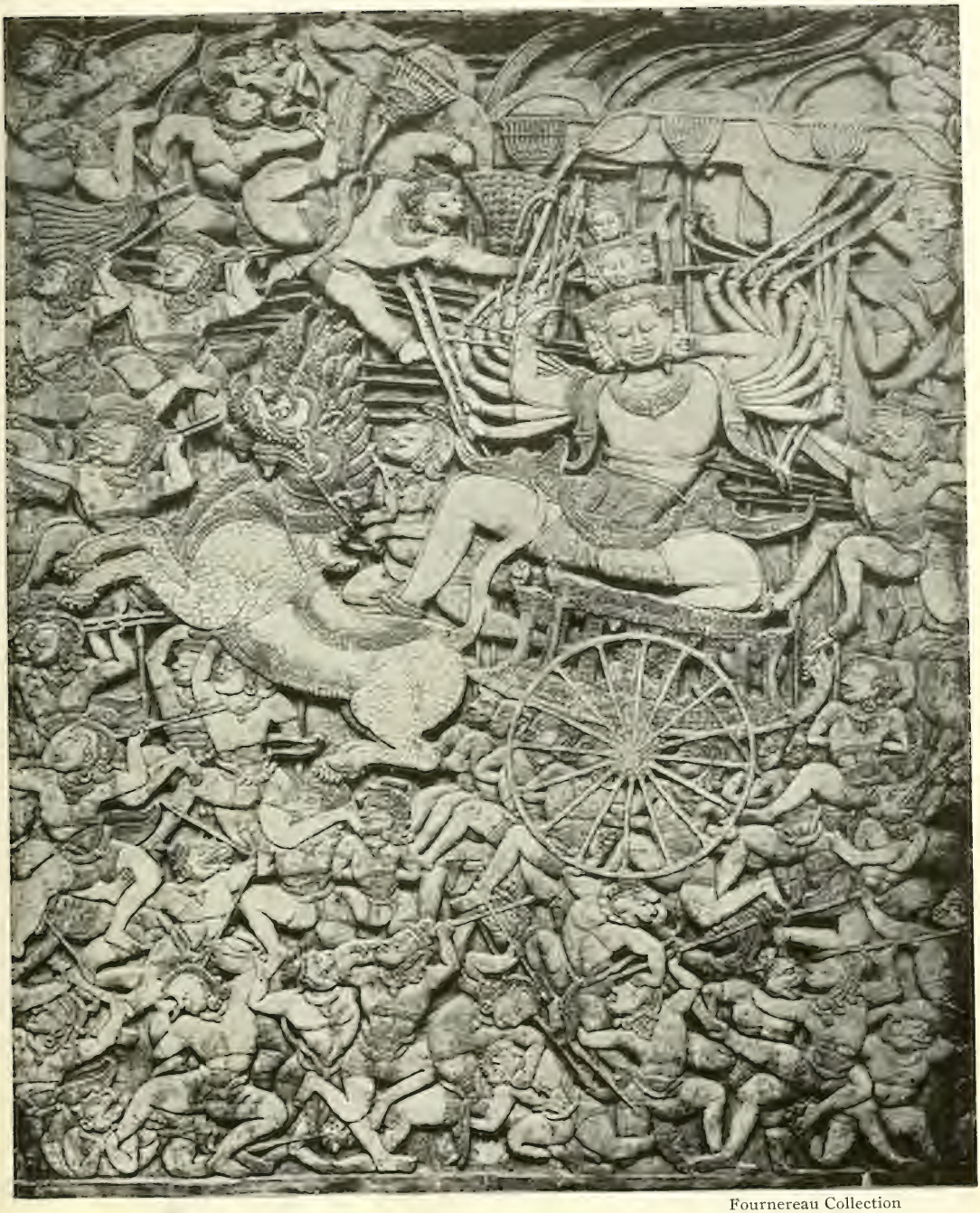
It is in these processional bas-reliefs that the life of the builders, the drama of their existence, comes to the surface, if it comes at all. In the battle reliefs, particularly, there is variety of subject and detail, and the sculptor tells more to the beholder of the present than he ever intended. You see unknown armies meeting, some with Hindu head-dresses, but a great variety of others, including not a few Greek helmets.

Fournereau Collection

ANOTHER DETAIL IN THE COMBATS OF THE RAMAYANA: ANGKOR WAT

Both sides are armed with spear, shield, cuirass, and war-club. The leaders and commanders are armed with swords, bows, and arrows, and are protected from the sun even in battle by enormous umbrellas. They ride upon elephants, horses, oxen, rhinoceroses, ostriches, deer, and, as if this were not enough, fabulous monsters the work of the artistic imagination.

One would suppose this to be legend rather than history; yet there is the *coupe-coupe,* still used by the natives for beheading criminals, and there is the identical pattern of the bullock cart in which I rode over in the morning, still



Fournereau Collection

BATTLE BETWEEN MEN AND MONKEYS: ANGKOR WAT

This represents the center of the combat, where the opposing forces are joined. The antagonists are so crowded in the melee that there is no background left. This is the best of the bas-reliefs, and is 160 feet long. The part here represented is no more than 10 feet in width. The panorama contains more than 1,000 figures of men and monkeys, and, like all the bas-reliefs, is carved in stone.

Fournereau Collection

HANAMUNT, KING OF THE MONKEYS, VANQUISHED IN THE COMBAT WITH MEN, EXPIRES IN THE ARMS OF HIS QUEEN, SURROUNDED BY HIS MOURNING FRIENDS, THE NOBLES OF THE MONKEYS: ANGKOR WAT

used as an instrument of torture. That is convincing. This must be history.

The bas-reliefs on the front of the building are by far the best. They are detailed and developed quite conscientiously as they understood things, and are marked by considerable animation. In two respects they are notably deficient, namely, in the treatment of the eyes and the feet. Whole rows and hundreds of rows of men with eyes just alike—not a particle of expression. And then the feet—was there ever a race of sculptors that didn't have trouble with the feet? In this case everything seems to have been tried by turns, by different workmen, no doubt, and you will see a yard or two of procession where the bottoms of the feet are turned outward toward the spectator, though the artist meant you should regard them as the tops instead; then again a front view of the men and side view of their feet. Yes, the feet are as ancient as primitive Greek or Egyptian.

The processional relief of Paradise and Purgatory is, in fact, a triple processional extending along the wall in parallel order. In the lower, human ingenuity is taxed to invent punishments terrible enough to satisfy; and it is interesting to note that a great many of these were rubbed smooth and shining by the hands of the present day. The paradise relief is really double, with the moderately happy people in the lower and the superlatively blessed sitting up above in little alcoves, which look for all the world like proscenium boxes at a theater.

One very interesting feature of the hunting processional is that the kings and other great ones are each honored with an inscription, doubtless his name and rank. So absolutely new and unknown is all this that not a word has been deciphered. Many of the columns of the inner temple are covered with inscriptions, all awaiting the translator.

Angkor Tom is three and one-half by four kilometers, or five and four-tenths square miles, in extent; that is to say, over 19 times the size of Angkor Wat. It is likewise surrounded by a wall, which is pierced by imposing gateways. Its principal ruins are the Bayon, the Bapuon, and the Pimean Acas, with numerous indistinguishable ruins within its inclosures.

The bayon alone—with its 53 towers, each with four Buddha faces looking toward the four cardinal points of the compass—was probably as large as the wat. Conjecture says that this was the royal treasury, and already cupidity has been busy in a vain search for the supposed treasures. Lofty trees reach high in the air above these ruins, and the monkeys and squirrels gambol in their tops undisturbed. Pimean Acas is a quadrilateral pyramid of colossal proportions, but of forbidding appearance in its present state; though, like all the others, it yields beautiful works in stone.

Who built these ruins, and when did they build them?

We have already said that the Khmers built them; but who they were, where they came from, when and why they built, and, finally, why they disappeared, nobody is yet able to answer with certainty. Tradition in the person of an alleged Chinese historian says that a powerful ruler once emigrated from India with all his followers to escape a still more powerful ruler; that he subjugated the people he found here and put them to work erecting these enormous edifices of stone.

But there are inscriptions to be mastered, which will be done some day, and then we shall know more about the subject. The letters closely resemble those of the Siamese and the modern Cambodian, and the work of deciphering may not be difficult.

Incidentally it may be remarked that the features of the men in the bas-reliefs resemble in some respects those of the Cambodians of the present day, and it is not improbable that the key to the past lies hidden in their monasteries. At present the safest guess as to the date of building is as follows:

For Angkor Tom, the 9th century A. D., or during the reign of Alfred the Great in England. For Angkor Wat, the 12th century, or 100 years after the Norman Conquest.

There are those who venture to particularize far enough to say that in the

fourth century B. C., a young prince of Delhi made war upon his father for the partition of his kingdom, was defeated and banished with thousands of his followers. They journeyed eastward, crossed the Ganges, the Irriwaddy and the Meinam, but did not cross the Mekong; for here they found primitive tribes whom they easily subdued. Here they established the kingdom of Cambodia, reduced the Siamese, the Annamites and all the tribes of the peninsula of Indo-China to subjection, and became very rich and powerful. In the course of the centuries, they built several capitals in different parts of their dominions, of which Angkor Thom is the largest. The Chinese historian, above referred to, visited them in the thirteenth century, just before, as alleged, they were overthrown by the Siamese and Annamites. The account he gives of their wealth and splendor is well nigh unbelievable; yet their sources of wealth were extraordinary, including as they did the tribute of the subdued tribes, the great fertility of the soil, and the ruby mines of Battamberg, which are still in operation. Could this have been the fabled wealth of India which tempted Columbus to venture westward, and quite incidentally discover a new world?

THE NATIONAL GEOGRAPHIC SOCIETY

THE seventh annual banquet of the National Geographic Society, on January 26, was the largest and most enthusiastic dinner in the history of the Society. Members were present from all parts of the United States. The special event of the evening was the announcement of the election of Mr. James Bryce, the British Ambassador, as an honorary member of the National Geographic Society, in recognition of his personal contributions to and interest in geographic science. A unique feature of the menu were dates grown in California, an account of which is given on page 291.

The program of speeches follows:

DR. HENRY GANNETT, PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY

Ladies and gentlemen of the National Geographic Society: One year ago, when I reported on the progress of the Society, I stated that it contained 74,000 members. Tonight the Society contains 107,000 members. This great membership enables it to be a very powerful factor, especially in the matter of diffusion of geographic knowledge, for which purpose the Society publishes the NATIONAL GEOGRAPHIC MAGAZINE. A year ago it was said that the magazine was just as good as it could be, but our members think it has improved during the year. Today the Society publishes other works for the increase and diffusion of geographic knowledge. During the past year the Society has kept close watch of the volcano at Bogoslof, a little volcano which once or twice or three times a year goes on a rampage.

We are fortunate tonight in the fact that Dr. Graham Bell has consented to act as toastmaster. As you know, he was President of this Society for many years, and it is largely due to his efforts that the present prosperity of this Society has come. I take great pleasure in introducing to you Dr. Alexander Graham Bell.

THE NATIONAL GEOGRAPHIC SOCIETY, BY DR. ALEXANDER GRAHAM BELL

Mr. President, ladies and gentlemen of the National Geographic Society: In thanking you for the honor conferred upon me by selecting me to preside over this meeting as toastmaster, allow me to congratulate President Gannett and the National Geographic Society upon the continued growth and prosperity of the Society. Do you realize that this growth and prosperity is unprecedented in the history of the world? There has never

been in the history of the world a scientific society that has increased in influence and power as the National Geographic Society.

As I have been associated with the Society since its very inception, you may perhaps pardon me for speaking for a few minutes of the Society itself, and of the causes that have led to this great growth. In the year 1888 the Society was organized under a national charter "to promote the increase and diffusion of geographic knowledge." Just think what that means: *To promote the study of the world upon which we live.* A truly great object for a little, feeble organization to undertake. At that time we had only about 200 members.

The Society had no endowment, nothing coming to it but the membership fees. No millionaire has since come forward to help us out, and yet today the Society has a great endowment raised by its own efforts. We have now an annual surplus, over and above all the running expenses of the Society, amounting last year to $43,000—a surplus to be devoted to the promotion of geographic science. Why, that is equivalent to more than four per cent upon an investment of $1,000,000. We never had to take off our hats to any multi-millionaire for having endowed the Society with a million dollars; we have done it ourselves.

THE EARLY DAYS OF THE SOCIETY

When I come to look back upon our early days, what a different condition of things prevailed. We had only about one thousand members and the Society was living from hand to mouth. Like many other scientific societies, we constituted a strictly technical organization.

We supported the NATIONAL GEOGRAPHIC MAGAZINE, at that time a valuable technical journal that every one put upon his library shelf and very few people read. It was valuable, it was important, but did not contribute anything to the financial support of the Society.

In spite of the fact that the members of the Board of Managers and all the officers of the Society, including the editor of the magazine, served without pay; and in spite of the fact that our lecturers, as a rule, cost us nothing excepting an occasional honorarium to cover traveling expenses, our income, being derived exclusively from membership fees, was hardly sufficient to pay the printer's bill for the magazine, the rent of our lecture hall, and the ordinary running expenses of the Society. Deficits were by no means unknown.

We had no permanent home. Half an office room constituted our headquarters, and in shifting from one building to another, as happened more than once, a feeling of unpermanency ensued and valuable material was in danger of loss.

Then the use of the Hubbard Memorial Building was offered to us in memory of our first president—Gardiner Greene Hubbard—and for the first time we possessed a permanent habitation that in its beauty spoke of the position to which we aspired. But it threatened to be a white elephant, for we did not even have the means to provide for its lighting or to take proper care of it.

It became a matter of vital necessity for the Society to increase its membership. Necessity spurred the Board of Managers into activity; and they adopted a new policy—unique, so far as I know, in the history of science. I do not know of any other scientific society that has ever adopted it, and I do not know of any other society that has succeeded as the National Geographic Society has done. Now, how was this accomplished?

First of all, instead of limiting our membership to strict geographers, we threw open the doors of membership to all who desired to promote the increase and diffusion of geographic knowledge. We had a membership of one thousand in the District of Columbia; we had ninety millions of people outside of the District of Columbia to whom we could appeal for an increase in our membership, but all we had to reach these outside members was our magazine. Our Washington members enjoyed the course of lectures, but the outside members would have nothing but a magazine to hold them to the Society, and the question was, how could we hope to interest

thousands and thousands of people in a strictly technical geographic magazine.

It was obviously necessary to change the character of the magazine and to adapt it to interest a larger circle of non-technical members. We adopted this policy with an aim to making the magazine support the Society. We did not mean to lower the scientific standard of the magazine and make it simply popular, but we wanted to add certain features that would be of interest to everybody.

But in starting out to make a magazine that would support the Society, instead of the Society being burdened with the magazine, a man was of the first necessity; if we did not get the right man the whole plan would be a failure, and I can well remember how our Board of Managers discussed this proposed plan, and the difficulty of getting a man, and how the idea was laughed at that we should ever reach a membership of 10,000. Why, it was ridiculous. Geography, the dryest subject of all in our schools, how could you expect a membership of 10,000 in the United States alone!

As I said, in the beginning, we found it necessary to get the proper man, but fortunately we found him. A young man who had made a very brilliant record at Amherst College was engaged as assistant editor of the magazine to stir up these new ideas, and to put new life into the scientific journal. But the Society did not have the money to pay his salary; that had to be raised by voluntary contributions from interested members. And so Mr. Gilbert H. Grosvenor commenced his work in 1899. He speedily captured the Society—and incidentally he captured one of my daughters.

Mr. Grosvenor later became Editor and then Director of the work of the Society. We have been very fortunate in securing his services, and with the intelligent action of an unusually fine Board of Managers, and the cordial support of the members of the Society, the success of the Society has been secured. We have increased to 107,000 members and we are still on the upgrade. There is no reason to suppose that we are going to stop growing.

THE PRESENT CONDITION OF THE SOCIETY

Our magazine has become the greatest educational journal of the world. It goes to thousands of schools. Its circulation is greater than that of the *Century Magazine, Harper's Magazine,* or *Scribner's;* it is as large as that of *World's Work, Review of Reviews,* or *The Outlook,* and our outlook is as good. There is no reason why the circulation of our magazine should not increase, and there is no reason why the National Geographic Society should not be placed in the possession of an endowment fund for geographic research, of its own making, many times that which it now possesses.

Progress in securing ways and means has been accompanied by difficulties in other directions. So far as scientific discussion is concerned, the Society has been swamped by its own success. In the old days we had a small scientific society that would meet at the Cosmos Club for the purpose of carrying on technical discussions. Now we cannot do that. We cannot even meet in our own beautiful home on Sixteenth Street for this purpose, for we have grown too large. Who can discuss questions in the presence of one or two thousand people? Even our most technical lectures were attended by too many persons to be accommodated in our own hall at the Hubbard Memorial Building. Even the largest lecture hall in Washington has been found insufficient to receive the large audiences that crowd to our lectures.

We tried the experiment this year of having each lecture repeated, once in the afternoon and again in the evening, and to our surprise the hall is crowded upon both occasions. The question of how to revive scientific discussions has been a perplexing matter for the Board of Managers.

It has been proposed on various occasions to elect Fellows to the Society, and then have meetings of those Fellows for technical discussions. There has been considerable feeling, however, against a class distinction of this kind, which is all very well in a monarchical country, where aristocratic distinctions

are recognized, but is somewhat out of place in a republic like the United States.

Another plan is now working itself out which I think will afford the final solution of the problem. All large bodies act through committees, and we have in the Society a Committee on Research, which guides us in our appropriations of money for that purpose. There is no reason why that committee should not be enlarged, and it is now proposed to meet the question of scientific discussion in the Society by the enlargement of the Research Committee into a small society within the Society, which can meet in the Hubbard Memorial Hall to discuss scientific matters.

In relation to our contributions to science we are now able to do what has not been possible for us before—contribute substantially to the support of geographic research, under the direction of our Research Committee.

We have not done very much in this respect in the past. We thought, while we had the opportunity, we had better look out for the Society itself first, and form a sinking fund in case of an emergency. We have over $100,000 in that fund now and are beginning to devote a larger and larger amount each year for research.

We commenced by sending small expeditions to study the volcanoes of Mont Pelée and La Soufrière. We also sent representatives to the Arctic regions, and did what we could, in a small way, to help Peary's last expedition which discovered the North Pole.

There is one subject that is of profound interest to us all, the glacial period in America, the time about when man made his first appearance on the earth. How can we study that glacial period? Surely it would be best to begin by studying the living glaciers of the world. A great deal is being done in this direction in Europe, and especially in Norway; but we have in Alaska a glacier system unrivalled by the rest of the world, the study of which may throw great light upon the explanation of the glacial period itself.

The National Geographic Society has supported for three years past a special expedition in Alaska, to study the glaciers of that country, under the leadership of Prof. Ralph S. Tarr, of Cornell University, and Prof. Lawrence Martin, of the University of Wisconsin. A popular account of these explorations has been printed in the National Geographic Magazine; and the great volume, giving the scientific results of this work, upon which we have already expended over $18,000, is expected to be published this year, in October. It will be one of the first contributions to geographic knowledge published by the Society.

We have been amply able to encourage the researches of individual members by publishing the results in the National Geographic Magazine, but this will be the first great work showing the activity of the Society itself in the field of geographic research.

Election of Mr. Bryce to Honorary Membership

We are honored tonight by the presence of one the world always delights to honor, His Excellency the British Ambassador.

The members of the Geographic Society are especially interested in James Bryce and his career, from the fact that his inherent bent since boyhood has been geography. When he was only twenty years of age he made a special examination of the flora of the Island of Arran and at twenty-one published an account of his studies. We probably all of us know something of his well-known work on "Trans-Caucasia and Ararat." I believe he was the first, or one of the first, since Biblical times, to reach the summit of Mount Ararat. I do not know whether he has been in the habit of climbing mountains ever since, but I notice that in 1899 he was president of the Alpine Club.

However, that has not been the subject that has especially interested us in his career. It is his profound study of peoples and countries and customs. We have learned more about our own institutions from Mr. Bryce's book on "The American Commonwealth" than we ever knew before. I do not think the British

government ever did a more tactful or a more graceful thing for the American people than to send to this country as their representative the author of "The American Commonwealth." They sent us a man who understood us and a man who understood our institutions. But Mr. Bryce's knowledge is not limited to the United States. His great work on "Impressions in South Africa" shows him to be just as much a master of Africa as he is of America. Indeed I doubt not but that he owes his preeminence as a statesman to the profound knowledge of countries and peoples that he possesses that can be utilized by the British government.

Your Excellency, the National Geographic Society recognizes very fully your eminence in geographical research of the very highest type, researches relating to the countries and peoples and institutions of the world, and I have been requested by the Board of Managers to announce tonight that they have elected you an honorary member of this Society.

We cannot hope, Your Excellency, to add honor, or to confer honor, upon one so eminent as yourself, but the Society will confer honor upon itself by adding your name to the list of eminent men who constitute the honorary membership of the Society.

ADDRESS BY THE BRITISH AMBASSADOR, MR. JAMES BRYCE

President Gannett, Dr. Graham Bell, ladies and gentlemen of the National Geographic Society: I thank you most heartily for the very high honor you have done me in electing me an honorary member of your Society. There is no honor that could come to me which I shall prize and cherish more, because I know of the long career of this Society, of the admirable work it has done and is doing for geographic exploration and research and of the new fields into which, as Mr. Bell has told you, it is always pushing its way.

You said, Mr. Bell, and I heard what you said with very great pleasure because it seems to me that your friendship has enabled you to understand what I feel, that there is nothing I am so fond of and nothing I have been all my life so interested in as geography. In fact, it sometimes occurs to me I have mistaken my vocation in life. It might have been better to have chosen the vocation of a traveler and describer of countries, rather than that of a lawyer, or writer, or politician, because there is, in my opinion, no pleasure comparable to that of studying the earth on which we live and endeavoring to obtain a knowledge of what the Creator has given to the different peoples on this earth, of that which it contains, and how the course of human events, from the time of the prehistoric ages down to the fuller light of our own time, has been determined by the physical circumstances under which the various races of mankind have been led in their several careers.

Whichever way you look at it, whether as the gradual unfolding of the forces of the human intellect, or as evidence of the wise and beneficent purposes of our Creator, there is no subject of more interest and better fitted to suggest profound contemplations than the history of mankind in relation to the history of the earth on which we live, and it is a history the full meaning of which is never completely unfolded, because every succeeding age adds something to it.

I feel, therefore, ladies and gentlemen, that there is nothing that the man who loves this earth and who loves his fellowmen ought to desire more than to devote himself to this inquiry, and certainly there is no better way than being admitted as a member to your Society, which is laboring in that glorious task.

It is very hard, ladies and gentlemen, to find anything to say that has not been better said by many of your members, who could claim a much fuller knowledge than I can upon the purpose and methods of geographic research; but when I was thinking of previous meetings at which I have had the pleasure of attending, it occurred to me on one occasion there came up for discussion the possible exhaustion of the field of geographic exploration. It has at these meetings been pointed out how much of the earth there was which was unexplored and unknown in the days when

you and I, Mr. Bell, were boys; when the map of Central Africa was one large empty space, with a little line of eminences, called the Mountains of the Moon, drawn across it; when the interior of Asia was almost unknown; when the Arctic regions had been so imperfectly explored that it was not known that Greenland was an island, or that there existed a Northwest passage, and even when among the regions better known there were practically many tracts unsurveyed.

More work has been done within the last sixty years than I suppose was done in the one hundred and fifty years preceding, and it is true there does not now remain very much of the earth's surface with which we have not some acquaintance. Africa has been entirely opened up, especially by the journeys of Prejevalsky, Younghusband, and Sven Hedin, and years of study have given us a pretty complete knowledge of Central Asia.

OPPORTUNITIES FOR GEOGRAPHICAL SOCIETIES

While traveling in South America a year and a half ago it occurred to me that there is another branch of descriptive geographical science the importance of which is only beginning to dawn upon us, and which may occupy us for a long time to come, even after we have come to know the surface of the earth in the sense in which the surveyor knows it. What I refer to is the discovery of the possibilities of each part of the earth for supporting the life of man and for subserving human industries.

It is extraordinary how much has been accomplished of late years in that direction. Take your own country: There were large tracts of your western regions which were supposed to be unprofitable. You have succeeded in utilizing those waste tracts in three ways, one of them an old way, but two of them new. The old way was that of irrigation, which you have conducted in your West upon a grand scale, both in results and in example. The results have very much benefited a large population by enabling them to use what were once useless deserts. The example is stimulating Australia and South Africa.

The process of dry farming has made available tracts which were previously considered useless, and now we all trust that by the application of those methods a happy and prosperous population may grow up in parts of your territories and in ours where formerly the want of rain forbade tillage. Speaking as a Briton, I desire to tender to you and those of your scientific men who have worked in that field our thanks for your discoveries, which promise to be of the utmost service to arid tracts of the British Empire dominions in India, as well as large parts of Australia and South Africa.

The third method, not so fully developed, but which I believe has a great promise for the future, is that of discovering the plants which are fit for growing in dry regions and for supporting live stock there. I believe the botanical surveys going on under the auspices of your Agricultural Department open up a prospect of making available for the support of live stock large tracts now unprofitable, simply by finding plants that can live in dry regions and furnishing food for animals in deserts previously barren. That is an illustration of what is being done in this country. The same thing is true of Canada, where we have discovered that grass can be grown and large cereal crops raised on regions that were hitherto considered incapable of producing any growth.

What I wanted to mention to you particularly was a very interesting and scientific study which presents practically the opposite problem, the problem of a country where there is not too cold a climate, but too hot a climate; where there is not too dry a sky, but too wet a sky, and where the question is whether man will be able to resist the tremendous forces of nature, and so to turn to account the appliances of modern science that by their help we may render useful to man a vast region, which a torrid sun and torrential rainfall have hitherto rendered unavailable.

The region which I speak of is almost the last part of the surface of this globe

DATE GARDENS IN NORTH AFRICA (SEE PAGE 291)

which remains unutilized. You have all noticed how rapidly the population of the globe has expanded and how rapidly it continues to expand, and how it looks as if before very long, within the course of a century or two, there will hardly be upon many parts of the world comfortable standing room left for the population.

THE VAST UNEXPLORED REGIONS OF SOUTH AMERICA

It therefore becomes of greatest importance to ascertain what regions can be made available for producing food and for the habitation of man that have not been touched as yet. The largest of those, I suppose, is to be found in the vast central area of South America, which consists of the basin of the great River Amazon and the basin of the Puraná and other tributaries of the Rio de La Plata. You have there a region to be measured by many thousands of square miles, which is at present inhabited only by a few wandering Indian tribes, most of them in the very lowest stage of savagery. Latterly the bands of rubber gatherers have been penetrating into some of the districts, and it

DATE GARDENS IN NORTH AMERICA (SEE PAGE 291)

is to be feared in some districts working much evil upon these helpless tribes, whom they have forced into a sort of slavery. Rubber has become an article of great commercial value, and, as the owners of automobiles know, it has become a commodity in which there is a great deal of speculation and of which the price has latterly tended to rise.

This enormous area is traversed by gigantic rivers, but the navigation of these rivers is interrupted at some points, and at some of the important points where it is interrupted engineers are at work constructing railroads. A year ago I had the pleasure of meeting an American engineer in Bolivia who was at work on the shore of one of these rivers for the purpose of opening up its territory by making a line from the lower navigable parts to the upper. This enormous region, almost as large as the United States, leaving out Alaska—for it includes a very large part of Brazil and large parts of Bolivia, Peru, Ecuador, Colombia, Paraguay, and Argentina—is very hot and it has a very wet climate.

In the rainy seasons the great rivers that traverse it rise so that they flood

their banks for fifty, or one hundred, or two hundred miles on each side, and it has been usually supposed by those who have explored this country along the rivers that, owing to these floods and owing to this climate, it would be impossible to turn the country to account, because the amazing energy of nature, making things grow faster than they can be cut down, renders it impossible to keep the land open for the service of man. I have been told there have been recently discovered all through this area elevated grounds which are perfectly fit for human habitation and cultivation and where settlements can be established. When that has been done it will be possible to consider the still larger problems of reclaiming the lands below and making them also available.

I suggest this to you as one of the most interesting and remarkable problems which will remain to be solved during the next fifty years. With all the resources of geographical science, including those branches allied to it, such as botany, geology, and meteorology, it will be the task of geography and those allied sciences to consider this South American region from the point of view of its adaptability to human use, and there will be nothing more interesting for those of you who are still young than to follow and to watch during the next fifty years the process of seeing what human science can do to reclaim these lands for the service of man. I suggest this to you, ladies and gentlemen, as one of the new fields into which geographical science will advance, one of those directions in which our powers of invention and application will be tested. I say that with particular pleasure to you here, because you belong to the nation that has completed the greatest work man has ever attempted upon the surface of this planet.

PANAMA CANAL

Nobody can visit the Isthmus of Panama; nobody can look at that canal and its immense locks, and at that wonderful cutting through Golden Hill at Culebra; nobody can think of the history of that Isthmus and the results which the opening of the canal may have on commerce, politics, and international relations of the great peoples of the world, without feeling that you have done a work such as has never been done before, and such as can never be done again, for there is no other isthmus whereon to do it.

As this may be deemed to be an appropriate opportunity for me, I would like, if I may presume to do so, to say on behalf of my countrymen, who have also had a great deal to do in exploring the outlying parts of the world and in helping to carry forward civilization and to open up commerce along many lines—how much we appreciate and how much we admire what American energy and skill prompted by an altruistic regard for the interests of the whole world has been doing at Panama. It is with high ideals before your minds that you have undertaken this work, trusting that all mankind will profit by it, and when the Isthmanian Canal has been opened to the commerce of all nations on equal terms the world will feel that you have done for it a service never to be forgotten.

THE TOASTMASTER, DR. BELL

I am sure we were all interested in His Excellency's remarks about the great work done by our agricultural department. Before introducing the next speaker I would direct your attention to one of the products of plant immigration into the United States. You will find upon the table in front of you a souvenir of American-grown dates, and if you think that it is an easy task to introduce plants from abroad into this country read the little story of exploration that shows the history of those dates (see pages 278-279).

There is no part of the earth's surface that is attracting more attention at the present moment than Persia. We are all interested in Persia, the land of romance of the past, and now our heart goes out to Persia in her troubles I am sure that we shall listen with great interest to the remarks of the present representative of the Persian people in America, Mirza Ali Kuli Kahn.

MIRZA ALI KULI KAHN, CHARGÉ D'AFFAIRES OF PERSIA

Mr. Bell, ladies and gentlemen of the National Geographic Society: It is indeed a high honor conferred upon me by this Society to invite me to say a few words to you this evening. It may be because I belong to a nation which is one of the oldest occupants of a geographical situation on this earth that I have been called upon to contribute a word or two to the discussions of this evening.

What may be looked upon as most appropriate to touch upon in the course of the remarks I am going to make would be the inner side of the activities of this Society itself. The outer and scientific side of it has been so thoroughly represented by the speakers before me that you might perhaps be interested now to hear something of my understanding of the inner aim of this Society. To me, the chief duty and activity of this Society is its moral and spiritual efficiency—chiefly the work it is doing for the peace of nations.

From time immemorial there have been here and there men who have been seeking knowledge by travelling throughout the world, believing that by so doing they would be able to secure knowledge and diffuse it among their own people, and thus make the knowledge of one nation common to another, and prepare the way for a day when a better understanding shall exist between the nations of the world.

Belonging to an ancient nation, I may call your attention to the records of our history, which starts from a remote antiquity. As far back as 260 years before the deluge of Noah, there lived in Persia King Tahmooreth the Div-band, the king who subdued the demon of evil. He is famed for having transformed it into a horse and ridden upon its back, and the old records affirm that as long as he lived and rode upon the back of that horse evil had no activity and peace reigned. He is also looked upon as the first man who gave us the alphabet, the letters, and bestowed the arts upon the people of my country.

Later on in our history we find other instances of men who, actuated by the spirit of search for higher knowledge, journeyed far in order to secure and introduce it among their own people for the enlightenment of their own race.

Among such men three stand lofty, especially before the eyes of the western world, because of their connection with the spiritual history of the Christian nations. I refer to the "Three Wise Men" who went over from the southern city of Kashan, 120 miles south of Teheran, led by the stars of guidance into that land and into that humble village wherein the greatest Prince of Peace was born to illumine humanity.

Another instance preceding that period by over four centuries is that of the great Kings Cyrus and Darius, the first beneficent act of whose reign, in order thereby to express to the world their love for peace, was to give liberty to the people of Israel whom they found in the Chaldean captivity, and to send them back, under their own leaders, to the land of their fathers, and to defray the expenses of the restoration of the glorious temple of Solomon, which was destroyed by Nebuchadnezzer some seventy years before.

Thus they demonstrated to the world their love for peace, because one might almost take that act of generosity by Cyrus as due to a prophetic insight into the future of that race which was to produce the Prince of Peace for the world. It was for this consideration that the prophets of Israel spoke of Cyrus as the "Anointed of the Lord" in the Holy Writ.

Even in the introduction into Persia of the religious movement of the Arabian Prophet we find a further trend towards search for higher knowledge and a reaching of the hand for the higher, the better. For the Persians carried out the saying of the Arabian Prophet, "Seek ye for knowledge, even though it be necessary to go to China." You have this statement of the Arabian Prophet, which clearly contradicts the saying attributed to Kaliff Omar in connection with the reported burning of the Alexandrian library.

It is not to be considered that this

spirit, in the people of Persia, of search for knowledge ended with the old Persians. No! It is due to this same spirit of desire for the knowledge of the present times that we find the Persians of today seeking with the utmost humility the highest things of modern civilization. Yea, it is this spirit which has compelled them to kneel before the principles of the great fathers of western liberty, and eagerly absorb those liberal ideas, which has enabled them, not in the course of a century, not in the course of fifty years, but in the course of six years, to establish amongst themselves a free form of government which has commanded the respect, the sympathy, and the admiration of the liberty-loving and truth-seeking nations of the world.

There was a time in the world's history, my friends, when peace, in a universal sense, was the furthest point from the mind of man. We see that in about seven or eight hundred years before Christ the wisest among the Greek philosophers, called Thales, would boast of the fact and pray to the gods that he was born a "Greek" and not a "barbarian." They were so set in their ideas, those ancients, that they glorified in a magnificent aloofness from the rest of the world.

Today, on the contrary, the highest thinkers and exponents of the moral energy of humanity advocate the brotherhood of men. Such earnest advocates are not fanciful dreamers, but they are the great law-givers, law-makers, and executives of the human race. Among those great executives you people of this great country are to be especially congratulated, because among the noted executives of the world the great President of the greatest republic the world has ever seen is the chief exponent and standard bearer of the cause of international arbitration. Not only an international arbitration in the sense that the ancients understood it, to wit, that two strong nations would come together and become friends in order to crush their weaker brother, not at all in the sense of the survival of the strongest, by which "the strongest" was often meant the one who could further weaken his weak brother, but in the sense of the lordly man whose strength lay in his ability to strengthen his weaker brother into higher strength.

It is for this positive nature of your activity that you and your great President are exalted and praised among the people of this world, for you are the standard bearers of that noble cause, which is the chief aim of this enlightened century. I thank you.

THE TOASTMASTER, DR. BELL

A message from one of our most distinguished members, President Taft. The President had intended to be with us this evening, but owing to the very inclement weather and a lingering cold his physician has forbidden him to go out. He wishes the Society continued success in its splendid work, and exceedingly regrets not being able to be with us. President Taft has honored the Society by attending three of our gatherings since he became President of the United States, and our disappointment is great that we cannot again welcome him tonight.

As we cannot afford much time for introductory speeches, I shall merely say that our next speaker is one who is abundantly able to speak for himself. I must confess that it is with some fear and trembling that I venture to introduce Doctor Harvey W. Wiley. However he may comment on our dinner and the pure food offered for our consumption, let me assure Doctor Wiley in all seriousness that we look upon him as one of the great benefactors of our country.

DOCTOR HARVEY W. WILEY

Mr. Symposiarch, Your Excellency the British Ambassador, Ministers of Foreign Countries and Angels of Grace of Washington: I can assure you, Mr. Toastmaster, that your fear and trembling was by no means equal to mine. This I may say is my début as a speaker on geographic subjects. I rely upon that great rule of oratory, ignorance, which has always been such a "present help" to the orator. Just in proportion as our knowledge increases our eloquence diminishes, and I am ambitious, in so

far as mere oratory is concerned, to be one of those, as was said of another speaker, who depends on his imagination for his facts and on his memory for his eloquence.

I was particularly impressed with the delicacy of the invitation which I had to speak here tonight when Mr. Grosvenor told me I might have six minutes. As I am known as an after-dinner speaker who never uses over four or five minutes, I consider that a compliment and an invitation to extend my remarks. The story of the growth of the Society as told by the toastmaster touched me greatly, because when this Society began to grow a very intimate friend of mine who resides in New Orleans sent me a letter and enclosed in that letter a number of postal cards, and asked me to take the matter up with the Post-Office Department. He said a certain organization, which he was certain was a fake organization, was trying to secure two dollars from him under false pretenses.

I followed with great interest the remarks of the Ambassador from Great Britain and the story which he gave you of the discovery of the interior of South America, in a country where he says there are only a few wild bands of Indians. I have just read a story of that country and am sorry to say those Indians are what you would call collateral cannibals; their chief food is monkey.

I am glad that I live in an age when it is not necessary longer to wander into distant regions to learn geography. All we have to do now is to sit still in easy chairs and our great men bring the world before us. Last year I had the great pleasure of hearing Admiral Peary lay bare the secrets of the North Pole in such vivid language and with such perfect satisfaction that I at once gave up my desire to visit that locality. A short time ago I sat in a comfortable seat in a theatre and saw the whole of the gorgeous parade of the coronation of King George the Fifth, all for the small sum of five cents. One week ago tonight I went with Professor Nitobe over the whole of that beautiful Island of Formosa and saw it in all its beauty and grandeur, at a smaller sum than five cents. So all that we have to do is to sit still and let the world come to us.

Do you know that the first wanderings of man, the first geographical explorations were caused by that universal need, food? If man had not needed food he would have still been an animal *in situ* and would have never moved from his domestic realm. It was the desire for food that first led man to wander, and it is that same desire that impels most of the exploration today. Just as the Ambassador said, we do not go into Brazil for the fun of it, but go there to get a greater supply of food for mankind.

However, we only have to sit down to a banquet, as here tonight, to have the geography of the whole world unfolded to us. We have olives from Italy, we have tea from Japan, we have coffee from Arabia, we have wine from the Rhine and the Gironde, we have meat from Chicago, we have butter—no, we have no butter because the small price of five dollars per plate would not permit it. But, thanks to Mr. Burleson, we can have low-taxed oleomargarine next year. And so the whole world passes in review. I was struck with the delicate compliment to me that my name was printed right on the program, though pronounced wrong. I was pleased with the fact that at least one of the dishes we have had tonight was safe and sound, namely the "sound oysters." I hope that is no reflection upon the rest of the program. But even a meal like this is nothing but an exploration, and we are all on voyages of discovery.

We sit at a table delightfully spread
  And teeming with good things to eat,
And daintily finger the cream-tinted bread,
  Just needing to make it complete
A film of the butter so yellow and sweet,
  Well suited to make every minute
A dream of delight, and yet while we eat
  We cannot help asking "What's in it?"

O maybe this bread contains alum and chalk,
  Or sawdust chopped up very fine,
Or gypsum in powder about which they talk
  Terra alba just out of the mine;
And our faith in the butter is apt to be weak,
  For we haven't a good place to pin it,
Annatto's so yellow and beef fat so sleek,
  Oh, I wish I could know what is in it!

The pepper perhaps contains cocoanut shells,
And the mustard is cotton-seed meal;
The coffee in sooth of baked chickory smells,
And the terrapin tastes like roast veal.
The wine which you drink never heard of a grape,
But of tannin and coal-tar is made,
And you could not be certain, except by the shape,
That the eggs by a chicken were laid.

And the salad that bears such an innocent look,
And whispers of fields that are green,
Is covered with germs, each armed with a hook,
To grapple with liver and spleen.
No matter how tired, and hungry, and dry,
The banquet how fine, don't begin it
Till you think of the past and the future and sigh,
Oh! I wonder, I wonder, what's in it?

THE TOASTMASTER, DR. BELL

Our next speaker is our own Vice-President, Mr. Tittmann, the head of the Coast and Geodetic Survey of the United States, and he surely needs no introduction to his own Society.

VICE-PRESIDENT O. H. TITTMANN

Mr. Toastmaster, ladies and gentlemen: It is the plan of the managers of this Society to have at its annual dinner at least one address which shall present some important aspect of geographic science.

Descriptive geography has readily commanded the attention of the reader, whether he lived in the time of Herodotus, of Humboldt, or of the NATIONAL GEOGRAPHIC MAGAZINE. My theme, however, relates to certain fundamental operations concerning geography which are not well known and the importance of which is not as well understood, though they mark the progress of civilization. These operations furnish us with our knowledge of the size and figure of the earth, which is the very foundation of geographic science. Through them it will ultimately be possible to introduce uniform accuracy in the map of the world, now being constructed by international coöperation on a uniform scale. They are of far-reaching importance in many fields allied to geography. Through them we measure the distances of the heavenly bodies by means of a yard-stick.

In the absence of our accustomed lantern slides, let me ask you to picture to yourself a globe on which you will note that three-quarters of the surface represented is water and only one-quarter land. The trigonometric surveys conducted on this one-quarter of the globe by the various governments of the world are the basis of all mensurational geography. Picture to yourselves the network of existing triangulation depicted on the globe and you will find all Europe, excepting Turkey and the Balkan States, well covered. Russia has extended a thread of triangulation eastward into Asia. The great trigonometrical survey of India has covered that vast country with a monumental survey. The Federated Malay States are extending their triangulation. Holland has covered Java. The United States is at work in the Philippines. Japan, as usual, is not behind in the extension of its triangulation. The French, in coöperation with the Spaniards, have crossed the Mediterranean with long triangles, and have done remarkable work in Algiers. You have all heard of the Cape to Cairo Railroad, but few know that the British are triangulating southward through Egypt and northward from Cape Town and through Rhodesia, and the Germans will doubtless fill the link which extends through their sphere of influence. The Australians are also at work.

Coming to our own hemisphere, we find that the United States has an extended trigonometric survey. Canada has but lately organized one, and has already begun to fix its geographic coördinates by the trigonometric method. Mexico has a commission for the same purpose, and has extended a triangulation through about 10 degrees of latitude and will connect with the triangulation of the United States. Central America is a blank. In Peru a small triangulation, famous as having been measured by the French in the 18th century and remeasured by them with greater refinement a few years ago, serves but to show how much remains to be done. The Argentine Republic and Chile are just beginning operations.

The upshot of the review of these activities is that accurate or dimensional

A TURKISH OFFICER IN TRIPOLI

geography is only in its infancy, and that by far the greater part of the globe is from this point of view still in the class of exploratory surveys.

Permit me to return to our own country for a moment. The needs of the government required surveys from time to time in separate parts of the country. We may instance those of the coasts, the lakes, the Mississippi River, and of the interior in general. The only way in which the detached surveys could be properly related to each other was by joining them with a network of triangulation, which has resulted in a uniform system of geographic coördinates which may be extended over Canada, and in fact over the whole of the North American continent, by the governments concerned.

How fortunate we are in respect to this matter will appear if we consider the conditions under which the European triangulations were developed. In each of the autonomous governments of continental Europe independent systems were carried on, and, what was worse, they were based on incommensurable or at least different units of length. This condition resulted in the formation, about 50 years ago, of the European Geodetic Association. One of the first fruits of its activities was the creation of an international bureau of weights and measures, which was designed, among other things, for the intercomparison of different units of length. This inter-European Geodetic Association soon broadened its scope and invited other than contiguous nations to join it for the avowed purpose of furthering the measurement of the earth.

All the great powers of Europe, by formal conventions, now recognize this association and support its undertakings. But not only the great powers of Europe, for Canada, the United States, Mexico, and Argentina have joined it, and Japan has set the example for Oriental nations by very active participation in the deliberations and execution of the projects of the association. It assembles every three years, and delegates come from all parts of the world to study and report on the progress made; to discuss methods and to recommend things which are desirable or necessary, and to coöperate in those things which are beyond the power of any one nation to achieve. And wherever there is international coöperation one may look for great progress.

The nature of the scientific questions discussed may be illustrated by the case of the Cape to Cairo triangulation, in which various nations are concerned. The association declared that it is most desirable that it should be accomplished. Another case is the junction of the surveys in India with those of Russia. Fifteen or twenty years ago it was thought that this highly important work was an unattainable ideal on account of political considerations. At the present time these particular difficulties have disappeared; but, to make the junction of these surveys, it would be necessary to establish stations in Chinese territory. It is therefore hoped that that ancient country will join the International Geodetic Association, and thus help in the great work to be accomplished and which is of such vast interest to geodesy and to geography in fixing on the maps the boundaries in their existing geographical relation.

The time will come when existing political boundaries will be defined by their geographic coördinates, and future generations will then be able to reproduce the political geography of the past without relying on the speculations of the archeologist or the historian, and I trust that when such boundaries, which the science of the day has fixed, are changed, it will be done only with the approval of the enlightened people of the whole world.

THE TOASTMASTER, DR. BELL

If there is any question on which I should like to expand, if it were not for the lateness of the hour, it is the great work of the American Red Cross Society. But it is unnecessary for me to expatiate upon the subject at all, for we have with us tonight no less a person than the Chairman of the National Relief Committee of the American Red Cross, Miss Mabel Boardman.

MISS MABEL BOARDMAN

Mr. Toastmaster, ladies and gentlemen: An affinity exists between the Geographic Society and the Red Cross of which you may not have been aware. Were you asked to bound the territory of the former Society would you not bound it on the north by the North Pole, on the south by the South Pole, and on the east and west by itself? So, too, you may bound the territory of the Red Cross.

I have noted in the NATIONAL GEOGRAPHIC MAGAZINE, that delightful picture book for us "children of a larger growth," that the Society has a fondness for rambling far afield, and so following its "wanderlust" spirit I am tempted to ask you tonight to take a little journey with the Red Cross into foreign lands. The Red Cross cars, doing their splendid work of teaching first aid to the great industrial army of our country, cannot carry us to these distant fields; good old Hans Christian Andersen's moon would be too slow a fellow-traveler, and I fear Dr. Bell might think us too weighty a body for the tail of one of his famous kites. Let us, therefore, all turn aviators for the nonce, and without fear of any Darius Green mishaps borrow that safest and most ancient of aëroplanes, the Flying Carpet of Suleiman, and the wind will waft us whither we will.

Rising from this banquet hall, our green and jeweled monoplane soars away to the southwestward to give us a passing view of the Mexican border. A perplexing problem met the Red Cross there. Insurrections bring parties into existence which are not signatory powers of the Treaty of Geneva, yet parties without an organized medical personnel. Under such conditions the Red Cross must exercise extreme care not to grant the use of the insignia to many who may express the desire to carry on a humane work on foreign soil. Let the emblem once be discovered in such an abuse as protecting the transportation of ammunition and its value is seriously impaired if not completely nullified. But caution did not mean inactivity.

In southern California we watch the women and children driven across our border by a state of anarchy, comfortably cared for in a camp settlement; funds are sent General Bliss to provide for the wounded; in Douglas we find a temporary hospital established, and at Juarez, where some hundreds of sick and wounded are in dire need of aid, General, now President, Madero welcomes the American Red Cross, with its doctors and nurses, until the Mexican Red Cross can itself take charge

A wish, and the pilot-wheel of our aëroplane turns us to the southward, to hover for a moment over those mighty locks, those immense dams, the vast Culebra Cut—over that most wonderful feat of engineering ever undertaken by man—until gazing down we thrill with justifiable pride. Had we reached there two weeks ago we could have heard the fine, inspiring spirit of that Titanic work, Colonel Goethals, give a report on our Canal Zone Chapter, so ably organized and carried on under Colonel Devol's chairmanship—a report given before not only the President of the Panama Republic, but before a host of those men who are building the canal, and who, as Colonel Goethals said, without rich men or millionaires among them, are capitalizing the charitable instincts of the American colony and enabling it to act as a unit in any emergency at any moment.

Look down below us, at Colon, where last March a fire left some 3,000 homeless and destitute, and listen to Colonel Goethals tell of the relief the chapter gave these poor people with the funds raised not only by itself from its generous members, but with the $5,000 the Panama government appropriated and entrusted without restrictions to this chapter to administer.

When some tall, young constructionist in the Culebra Cut tells you he belongs to the Red Cross, or some strong, manly foreman stops his car in the Gatun locks to half shyly inform you he is a Red Cross member, you will feel the glow of honest pride that these men are working not only with American brains and American hands, but giving with the

warm American heart for human suffering; that the makers of this great canal are putting some of the earnings of their labors into work for their fellow-men.

But we may not linger, for the wind sweeps us onward to the east, and our Flying Carpet hardly pauses for us to glance below at Tripoli, where last winter the Red Cross helped many Jewish victims of cholera and famine, before again it wings its flight to Montenegro to show us for a moment the Albanian refugees, for whose relief our Red Cross sent funds to the Montenegrin Red Cross, which did so much in their behalf.

Again our winged steed hurries us onward to the land of its own beloved Koran and lingers over Stamboul to recall to us that here our Red Cross lent a friendly hand to the suffering Mussulmen when the fire last year laid so much of their city in ashes. Neither race nor creed does the Red Cross know; only suffering humanity.

A word to the wind, for our time is brief, and it carries us swiftly away to the far eastern isles, where floats a flag we know and love. There from the picturesque lake in southern Luzon rises that strange but deadly little volcano of Mt. Taal.

Only last March, like some monstrous dragon, it quivered and muttered, and then early one morning poured forth with blasts of fire and ashes its venomous fumes to overwhelm the people of a score of tiny villages clustered along the shore. Over 1,300 were destroyed in a moment's time, and the green and tropical hills and valleys turned into a barren waste of gray desolation. Accepting only $1,000 from our Red Cross treasury here, the Philippine Chapter raised fourteen thousand more, with which it cared for those who escaped the fury of the devastating volcano.

Turning, now, northward in our flight, let us stop for a moment at Manila to gather up Dr. Strong and his assistant, Dr. Teague, that we may see at Mukden the field of their labors for the Red Cross. We, safely up aloft, may watch them in the heart of the pneumonic plague district, dressed like misericordia brothers, moving through hospital and laboratory, studying at the risk of their own lives this most fatal pestilence—studying it so well that when the international commission meets Dr. Strong proves its leading member in the successful suppression of the epidemic.

Does the wind with a moaning note warn us of sorrow and despair as it drives us southward? Creep to the center of our jeweled carpet that you may not glance over its gold-fringed borders, or else steel your hearts to the saddest scene of all, so appalling in its vastness of human misery, in the depths of human suffering.

Once more last winter famine stalked through central China, and again today its deadly grasp is laid upon hundreds of thousands of men, women, and children. Up and down the highways wander a starving multitude. Here a man wasted by hunger, carrying a dying mother from some distant village, stops to beat his head on the doorstep of a house as he begs in vain for work or food. There a gaunt, hollow-eyed woman holds a famished baby to her breast, while clinging to her skirts are pitiful children, whose little legs tremble as they walk, in the weary search for aid. Think of the mental agony of such men and women who must witness helplessly the sufferings of those they love. In desperation some of these honest farming-folk have become robbers and plunderers; hundreds of them every month forfeit their lives for their crimes. The children that survive are growing up to lives of beggary and vagrancy, so often has famine succeeded famine.

Not content with its efforts to alleviate some of this untold suffering, our Red Cross last spring offered to the Chinese government the services of an expert engineer on river conservancy to study and report on the prevention of the floods that cause those oft-repeated famines. For six months Mr. Jameson, the Red Cross engineer, with 30 bright Chinese assistants provided by the Chinese government, has been at work on the Yellow River, or Hwai River.

It is satisfactory to learn from his preliminary reports that he believes the building of power dikes and the deep-

ening of water-courses can prevent any usual floods and, moreover, reclaim great quantities of land for cultivation and provide work for thousands of famine sufferers.

In the meantime Mr. Jameson, Consul General Wilder, and Bishop Graves, of the Relief Committee, send the same terrible story of conditions in the famine district. Last year the Chinese government gave a million dollars for relief, but internal confusion and consequent business depression will prevent public and private contributions. Consul Wilder writes hundreds of thousands are in desperate need and the worst is yet to come.

Were it not for two new hopeful factors he would not repeat his cry to feed these hungry people. First, the relief funds will be expended for labor, according to Mr. Jameson's plans, providing work and at the same time repairing the dikes, both factions in China promising protection for the famine relief. The second reassuring feature is the fact that in the future the Chinese government will be in a better condition to care for its own, and an example of what can be accomplished will have been given it.

But after all—in the presence of need, suffering, starvation, and death—in the presence of facts like these, the wise saws of political economy, the deductions of the well-fed dinner company go flying to the winds. The man who loves his fellow-man, whose heart goes out to helpless, innocent children, cries, "I give what I can," and conditions only that it be applied to the best of human wisdom.

Has our little flight carried us among scenes too sad for an after-dinner story? Were it only to see the misery it would be so; but remember we fly the Red Cross flag, and under it the duty is not only to know the sorrow, but to know also the joy of helping those who suffer.

Even though our hearts are saddened, ere we turn homeward over the wide Pacific, we may smile on a passing picture in Wuchang of hordes of distracted Chinamen carrying all their portable goods to place them under the protection of some Red Cross flag.

And now that the Flying Carpet of wise old Sulliman has brought us safely back to this good land, will you not agree with me that the flag under which we made our flight—the flag to which the poor Chinese fled for protection, which has meant so much of help and comfort to our suffering fellow-men throughout the world—is a flag to which every one of us tonight, no matter what his race, no matter what his creed, may pledge his loyal fealty?

THE TOASTMASTER, DR. BELL

Japan has sent to America a great many students, who have gone to our universities and carried off our highest honors, and now she sends teachers to us, from whom we may learn. We are honored tonight by the presence of the great educator of Japan, Dr. Nitobe, of the University of Tokio, who is well known to us all as the author of Bushids, the work which has made known to us the high code of morality possessed by the Japanese.

DR. INAZU NITOBE.

Mr. Toastmaster, ladies and gentlemen: We are well aware under what obligations the toastmaster of the evening has placed the world, but the unabated admiration and confidence, as well as the curiosity, of mankind are still looking forward for further revelation of his genius, and I for one wish to ask a little favor of him. I wish him to add to the long list of his inventions, already pretty long, another: a new kind of phone whereby when one speaks in an unknown tongue his words, by the time they reach the ears of his hearers, may be so translated that all may understand him.

This is, of course, nothing new in the history of inventions. We are told, in a book which we are instructed not to disbelieve or to doubt, that once upon a time good Christians, apostles and fathers, made use of such a device on that memorable day of Pentecost. But ever since Christianity left the soil of Asia this precious art seems to have been lost. Perhaps you do not miss it out here, but I do very badly, and especially on an occasion like this, when I

feel promptings within my heart, when I feel my thoughts and sentiments rising and asking for a fuller expression in the presence of so distinguished and so cosmopolitan a company as this. And then we do miss it as a nation.

A poet of the British Isles, singing of the freedom of the Swiss mountain-dwellers, has written,

"Two voices are there: one is of the sea,
One of the mountains—each a mighty voice."

Now it is superfluous for me to remind the members of the National Geographic Society that Japan is only sea and mountains. Conclusion: that the voices of Japan should be doubly audible. Yes, I believe that her voice is audible, even at a distance separated by half the convex world.

But sometimes, in being carried over the wide ocean, it may sound a little raucous, as if the speaker had caught cold in the dampness; or sometimes, passing through the dry atmosphere of this continent, it may sound husky, as though it had proceeded from a rasping sore throat. Geographical conditions certainly affect the human voice. But the worst thing is that, for the want of a proper kind of phone, the words which the voice tries to convey may too often not be clear enough, and this want may become serious when our Oriental language, reaching the Pacific Coast, must first be translated by patriotic American citizens, so called, who somehow do not speak English themselves.

There is a term in our Japanese vocabulary which is of every-day use. It is not a new word, either. A shrill, screeching voice is called *"ki-iro-no-koye,"* which, literally translated, means yellow-colored voice; a voice indicative of excitement, or lunacy. Self-respect demands that we close our ears to it, whether it proceeds from that or this side of the Pacific Ocean.

I wish the American people would listen to the normal, sane, genuine voice of our people; for, with or without interpretation, you can easily understand that the burden of its message is heartfelt greetings to America, expressions of unalloyed good will, of traditional friendship, of respect for your country, of admiration for the name of Washington, adoration for Lincoln, and Godspeed to the arbitration scheme of President Taft.

If there is no immediate prospect of regaining the lost art of that pentecostal day, I must beg the National Geographic Society to clarify the atmosphere of the Pacific Ocean, so that messages can be transmitted unimpaired. I believe geography owes much to language, and it ought to do what it can to alleviate the imperfections and inconveniences of tongues.

It is written that with the confusion of tongues among the builders of the Tower of Babel, the settlement of new countries—in other words, geographical exploration and colonization—began.

Dr. Wiley has just told us that it was in search of food that migration began; but, according to the good old Book, it seems that migration began for another reason, namely, simply because the people could not understand each other. It is not at all impossible that the two causes of the dispersion of the race were closely related. It often happens that hungry people fail to understand each other!

If history repeats itself, I take it for granted that it is the rules and exceptions of English grammar which are largely responsible for the expansion of the English-speaking race. But I am afraid that geography rather delights in setting bounds for dialects and languages, and therefore I hold geography responsible for the present state of linguistic confusion.

Pending the invention of the new phone or the return of Pentecost, why should not geography, national or international, put forth an effort to satisfy the demands for universal communication and communion? And this is my message and this is my question: What will geography do? What will the National Geographic Society do for the promotion of a better understanding of peoples and nations that do not exactly comprehend each other's language when, as we say, jingoes speak in yellow-colored voices?

Now I wonder if I have spoken clearly enough to be understood? If I have not, the greater the need of a new phone. If I have, it is largely due to the prospective invention of our toastmaster, to whom, and to the ladies and gentlemen present, I wish to express my hearty thanks for this instructive and entertaining evening.

THE TOASTMASTER, DR. BELL

Japanese was the first foreign language spoken through the telephone, and Japan has itself supplied the instrument for translating Japanese thought into English—Dr. Nitobe.

I am sorry to say we come now to the last speaker of the evening, one to whom we would like to listen for a very long time. We all have the interest of woman at heart, and who can speak so well on "the welfare of woman" as Mrs. John Hays Hammond, the President of the Women's Welfare Department of the National Civic Federation.

MRS. JOHN HAYS HAMMOND

Mr. Toastmaster, ladies and gentlemen: It seems a proper note to close this harmonious and splendid geographic dinner with the home note. I come to you the mother of grown sons, a woman who has known hardships, has suffered and who has lived. For this reason I feel that I have a right to speak to you of woman's work.

By a natural evolution of life woman's work today extends far beyond the home. Not restlessness nor pampered idleness, but necessity has forced her to undertake such service as the work of the Women's Welfare Department, to protect her home. And where is her home? A noted educator said recently, in addressing a vast gathering of women's clubs:

"If your children get into the juvenile courts, then your home extends to that. When the child goes to school, the school becomes a part of your home. If the street before your house is dirty, then that is a part of your home concern. If the dairyman poisons your child by impure milk, then the inspectors of dairies is a part of your home."

In spite of the fact that we no longer brew nor bake, that our sick are turned over to trained experts, and our infants are brought up by formulæ, the old home instinct, that God-given instinct is still burning in our hearts. Instead of our own household the whole human family now absorbs us.

Gentlemen, we have outgrown our back yards; the public highways and all the environment of a great city—its factories, shops, and tenements—are logically our present field of work. Into the dark corners of these places it is woman's keen eye which penetrates. It is woman's patient industry which is ready to sweep and make clean those spots which in the race of competition your man's haste has made you forget.

We realize that your future citizens are in the hands of the women for the making. We nurture not only our own children, but the welfare of every child in the nation is equally our concern, because in this country even the newly arrived immigrant is a possible governor or leader. We women in our welfare work meet the men and women of industry in the factory and mine. We help them to better conditions in life. We endeavor to bring about more kindly understanding and sympathy between employers and workers, so that they may arbitrate their differences when the time comes.

Woman has her place in civic life. The responsibility of welfare work will develop and educate her. Her task will be to establish order, peace, and righteousness in the community, as she has done for ages in the home.

We hear much in these latter days of woman's drift into the material and practical at the expense of sentiment and domestic life. It is my belief that woman cannot and will not sacrifice upon the altar of these new and widening duties the sweet, solemn responsibilities that bind her to the ancient and honorable faith of womanhood. Rather, she brings to the new work all the qualities which have made her the successful mother, wife, and home-builder. God made woman the mother in the home. The stress of present time and need is making God's woman a vital factor in civic life. It is

the maternal spirit of arbitration extended to the community which will make woman the beneficent and peaceful power welcomed by men to help solve the world problems of today.

This is no surrender of rights already achieved by woman, but a pledge that the old-time woman, whom through generations you have learned to rely upon and love, shall not be lost to you, but shall return to you glorified in the dignity of her new strength.

THE TOASTMASTER, DR. BELL

The best of meetings must come to an end and friends must part as well as meet. Success to the National Geographic Society, and may we all be spared to meet here again another year.

A STORY OF EXPLORATION

The dates which were tested by the members and guests of the National Geographic Society were grown in the Federal and State Co-operative Date Garden at Mecca, California, and were the first American dates ever served at a great public function.

The dates represented a story of exploration and agricultural investigation by our government as full of fascinating detail and as thorough from a scientific standpoint as any explorations ever conducted by any government.

They were American-grown dates of a variety which has become the most famous date of North Africa—the Deglet Noor—and they represent one of the more than 200 varieties now growing in the deserts of our Southwest. We have in Arizona and California more different varieties of dates than there are in any other one region in the world—dates tan, brown, purple, and black; dates small and dates large; dates dry enough to be carried in the pocket like nuts, dates so soft and syrupy that they must be eaten on the spot, and even dates for cooking.

The foreign-grown dates on sale in our shops are, for the most part, the soft, sticky varieties—just the kinds best adapted to catch and hold the flying dust and dirt of the Arabian villages where they are packed, and our cleaner methods of handling will undoubtedly aid the popularity of American-grown dates.

To get these dates into the country it has taken three expeditions to the Sahara, two expeditions up the Nile, one to the oases of Tunis, one to the oasis of Siwa—for 25 years unvisited by a white man—one to Bagdad, and one to Baluchistan; while to get them established in Arizona and California has meant years more of careful scientific work.

Not only the soils of the various countries from which the dates came, but the soils in which it was proposed to grow them, had to be studied that they might be compared. Temperature comparisons were necessary; experiments had to be made to see how much salt the date palms could stand in their irrigating water. So much of the detail of cultivation had to be studied among the Arabs that one of the explorers of the Department of Agriculture studied Arabic to facilitate his work.

Date-growing is an industry adapted to the small grower and homemaker rather than to the operations of stock companies or capitalists, because the palms are rather slow to propagate, and need a good deal of personal attention. The localities where the cultivation can be successfully carried on are limited in extent and scattered over southern California, parts of Arizona, and possibly Texas.

In an average year one tree will produce 40 pounds of commercial dates, which bring a wholesale price of 25 cents a pound. As one acre contains 50 trees, the average product will probably be worth $500 an acre. Trees in Africa often bear for a century.

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Mr. and Mrs. Frank E. Altemus.
Mr. and Mrs. George C. Altemus.
Judge Thos. H. Anderson, Supreme Court of District of Columbia.
Mrs. Anderson.
Representative and Mrs. D. R. Anthony, Jr., of Kansas.
Hon. Allison V. Armour, of Chicago.
Mrs. E. T. Atwell.

A BAG OF ALLIGATORS, ON THE PANAMA CANAL ZONE

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Rear Admiral and Mrs. G. W. Baird.
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Mr. George Young, First Secretary British Embassy.
Representative and Mrs. H. Olin Young, of Michigan.
Mr. Rudolph de Zapp.

AMERICAN DISCOVERERS OF THE ANTARCTIC CONTINENT

By Major General A. W. Greely, U. S. Army

"When I refuse, for any cause, the homage due to American talent, or abate the tithe of a hair from just character or just fame, may my tongue cleave to the roof of my mouth."
—Webster.

CLOSE on the news of the American discovery of the North Pole by Robert E. Peary comes by cable from Australia the intensely interesting story of the conquest of the South Pole by that chief of the Norse vikings of today—Captain Roald Amundsen. Entering the broad field of Antarctic research, with keen perception and sound judgment he has profited by the experiences of his British predecessors, introducing innovations as to equipment methods, field work, and lines of approach.

His wisely chosen route to the Pole was due to a sagacious recognition of the fact that the great oceanic ice-cap known as Ross' barrier, flowing from the southeast, is diverted from its course by the mountainous coast of South Victoria Land, whose outlying cliffs are ground by the almost irresistible force of the barrier.

The onward movement of this inconceivably enormous body of solid ice, estimated by some to have a superficial area of 100,000 square miles, naturally produces fathomless fissures in and great upheavals on the surface of the barrier bordering Victoria Land, while the eastern sections along the coast of King Eddard VII Land remain in a state of comparative quiescence, with its surface unbroken by pressure and unmarked by crevasses.

Again should be noted Amundsen's originality in locating his winter home on the ice-barrier and his restless energy during the autumn in establishing advance depots on the colorless, unmarked ice-plain, with signals insuring their attainment after their burial by the winter snows.

While displaying high qualities of resourcefulness and unusual powers of endurance, Amundsen's human attributes

are most admirable and have won universal esteem and applause. One reads with pleasure the plain, straightforward story of his onward march and final success, told with unfeigned modesty, and further notes with intense satisfaction the absence of any assertive superiority over his friendly rivals, whose fortunes he views with a manly and generous spirit.

And so the whole world unites in homage of the highest character to this Norwegian sailor for his contributions to knowledge—contributions gained by such personal sacrifices of physical, financial, and self-denying character.

Another page of Antarctic history—which, though supplementary to the attainment of the pole, is of absorbing interest, especially to Americans—was written a week after Amundsen's return. A cablegram from Hobart, Tasmania, dated March 12, 1912, ran as follows: "The Australian expedition ship *Aurora,* concerning which there had been some anxiety, returned to Hobart today, after landing Dr. Douglas Mawson, the leader of the expedition and of the party, January 19, on Adélie Land, and another party under Dr. White (Wild ?), February 19, on Termination Land, discovered by the American Captain Wilkes, in 1840, on the edge of the glacier."

Among Antarctic explorers, Amundsen and Mawson would be the last to fail in homage to and in just appreciation of the invaluable work done during the past century by their predecessors. That work made possible the magnificent successes of Amundsen in reaching the physical Pole in 1911, and of Mawson's attainment of the South Magnetic Pole, in 1909, in 72° 25′ S. latitude, 155° 16′ E. longitude, and also his later scientific expedition to Wilkes' Southern Continent.

ENLIGHTENMENT ESSENTIAL TO NATIONAL HONOR

History reveals many instances in which not only individuals but also nations have failed to receive, or been temporarily deprived of, honor due for important additions to human knowledge or advances in the march of civilization.

When recorded history began, there were four continents unknown whose subsequent discoveries have been of unsurpassing geographic importance. As regards the two Americas, the rightful honor pertains to Spain, as is universally known. In the case of Australia, priority is unknown, claims being made by France, Holland, Portugal, and Spain.

With reference to Antarctica, through misinformation and neglect in the past, our countrymen have failed to pay "the homage due to American talent." The object of this brief memoir is to clearly and concisely present such facts as may conserve to America the rightful honor of both the original discovery of Antarctica as well as of first ascertaining and making known its definite existence as a continent.

Australian energy and courage, by the recent occupation of Termination Land for scientific research, have thus put an end to the anti-American campaign of many years' duration. During this period American honor has suffered from national neglect as well as from unwarranted assertions and disingenuous representations from foreign sources, thus beclouding the situation to American discredit. Moreover, claims have been made which attribute to European activities that priority of Antarctic discoveries which rightfully pertains to American explorers.

PALMER'S DISCOVERY OF THE ANTARCTIC CONTINENT IN 1821.

The earliest phase of American Antarctic exploration was due to the ambitious energies of Connecticut whalers, whose commercial and professional instincts impelled them to seek an extension of profitable sealing grounds. As is well known, the daring pioneer voyages of American fishermen successfully exploited in the 19th century even the most remote seas, and thus brought into our national coffers whaling products to the value of 332 millions of dollars from 1804 to 1876.

The discovery of the sealing grounds of the South Shetlands (see map, page 308) promptly attracted a fleet of New England whalers, which established its

base of operations at Deception Island, where seals were so plentiful that 50,598 sealskins were taken in one season, 1820-1821. The smallest vessel of the fleet was the sloop *Hero,* 44.5 tons, commanded by a youth of 21 years, Capt. Nathaniel Brown Palmer. While at the lookout maintained on the volcanic crater near Yankee Harbor, one of the sealing captains, Benjamin Pendleton, on a clear day discovered snow-capped peaks outlined against the southern horizon.

Realizing that the wholesale destruction of seals must soon exhaust the local supply, Captain Palmer, in an interval of fine weather, sailed southward, in January, 1821, to search for new fishing grounds. Reaching the new and hitherto unknown land, only some 70 miles distant, Palmer skirted its northwestern coasts, which he found to be a mountainous, snow-covered region, entered several bays, and saw sea leopards, though finding no seals. His farthest point in that voyage was about 68° S. latitude, 59° W. longitude. In his homeward passage Palmer fell in with the Russian exploring expedition commanded by Capt. F. G. von Bellingshausen, which, after an unparalleled voyage through Antarctic waters, had discovered the islands of Peter I and of Alexander. These were possibly the first seen, and certainly the first charted and named, land within the Antarctic circle. Palmer gave Bellingshausen full information as to his own voyage and discoveries.

Dr. Hugh Robert Mill, in his generally accurate and fair-minded "Siege of the South Pole," 1905, unfortunately follows the British attitude of indirectly discrediting Palmer's story as to the Russian admiral, saying (page 100): "It seems strange that if informed of the whereabouts of Palmer Land he (Bellingshausen) made no reference to that fact in his own book."

However, Dr. Henryk Arctowski, a Belgian professor, a Russian scholar, and an Antarctic explorer and expert, supports Palmer by a citation. In "The Antarctic Voyage of the *Belgica*" (in the *Geographical Journal,* 1901, 18:353-394), Arctowski states that "this meeting was also described by Bellingshausen himself, as can easily be seen by consulting the remarkable but still little-known work of that eminent Russian explorer (Dwukratnyja, 2:262-264)." It is to be regretted that Dr. Mill failed to verify the citation.

Mr. E. S. Balch, in his scholarly study ("Antarctica," Phila., 1902, page 95), admirably summarizes the results of Palmer's voyages. He ascribes to him, with undoubted accuracy:

1. Certainly the first explorer of the land lying south of Bransfield Strait, and extending for some 250 kilometers (over 150 miles) between about 57° 50′ and 62° 20′ west longitude; that is, of the northern coasts of West Antarctica from Liege Island to Joinville Island, both inclusive.

2. Discovered the northern end of Gerlache Strait.

3. Discovered the strait since called Orléans Channel. He also accurately adds: "This coast or these islands were christened Palmer Land, and they were so first charted in England, France, and America."

Palmer never realized that he had discovered a continent, and had thus placed his name among the immortals. Even after the discoveries of Wilkes, he claimed, in 1847, only the discovery of Palmer Land and the credit of sailing into the Antarctic Ocean to the distance of 340 miles southwest from Yankee Harbor.

However, Captains Edmund Fanning and Benjamin Morrell, contemporaneous whalers with Palmer, considered the land continental. The former writer says (Fanning: "Voyages," page 476): "From information that the author has in his possession it is presumed that the continent of Palmer Land does not extend further west than the 100th degree of west longitude." He adds: "It is reported that an extensive bank, with from 60 to 100 fathoms of water over it, has been discovered between the latitude of 66° and 69° south, to the westward of 140° west longitude, which may be con-

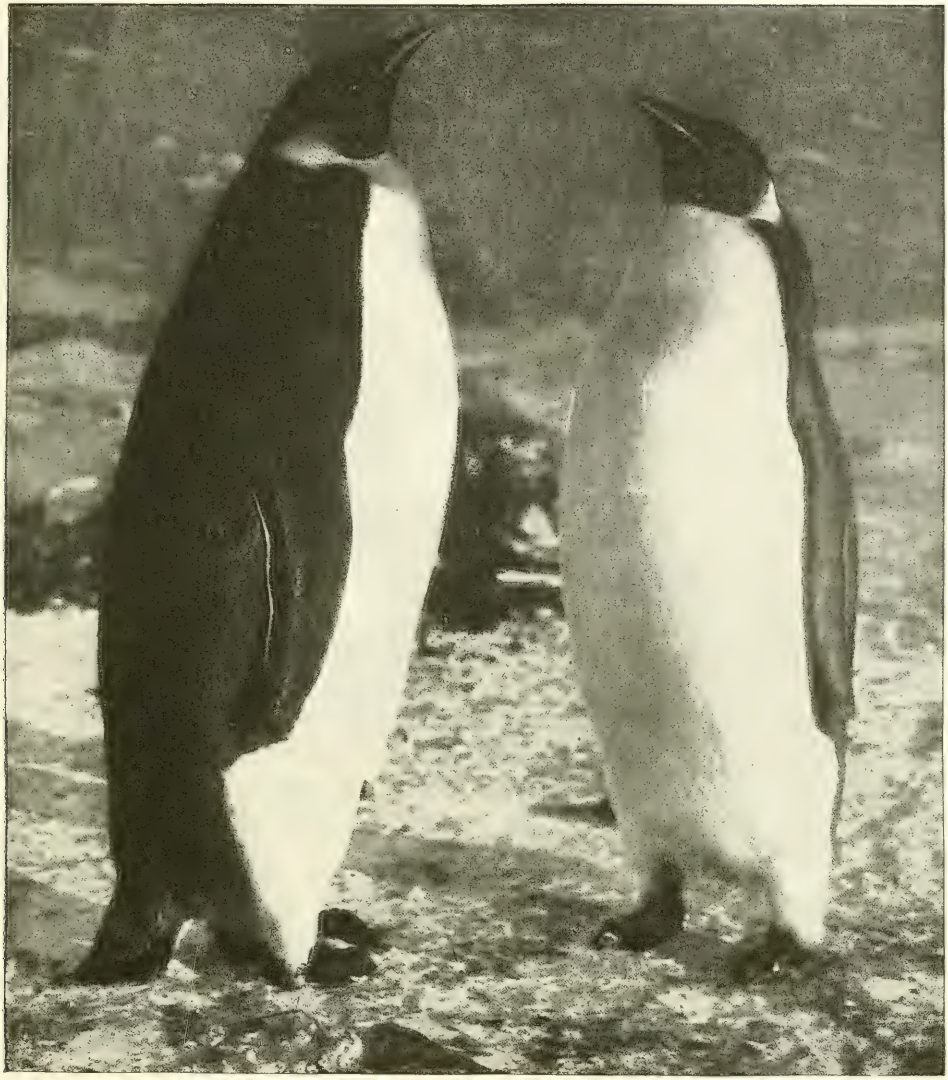


Photo by Sir Ernest H. Shackleton
From "The Heart of the Antarctic," by E. H. Shackleton (J. B. Lippincott Co.)

TWO EMPEROR PENGUINS ON SOUTH VICTORIA LAND

nected with extensive land to the south of it." *

Long designated as insular, the continental character of Palmer Land has been gradually proved through the discoveries of Larsen, 1893; of Nordenskiöld, 1903, and of Charcot, 1910.

As it is now acknowledged that this land is a northerly projection of the continent of Antarctica, to this American sea captain must be given geographic credit second to the other only known discoverer of a continent—Christopher Columbus—who no more than Palmer realized the greatness of his work.

*Attempts have been made to discredit Fanning, a sealer, making no claims to scientific accuracy in astronomical positions. His general statements are strikingly confirmed by the discovery by the *Belgica*, under Gerlache, of a continental plateau, from 75° to 103° W. (the *Belgica's* farthest), sloping gently to the south, with soundings from 100 to 250 fathoms. Unquestionably the plateau extends farther west.

HOW PALMER LAND BECAME GRAHAM LAND

Among the curious recurrence of parallels in history is the surprising fact that the only men who have discovered continents—Columbus, the unknown discoverer of Australia, and Palmer—should each have failed in receiving that highest form of geographical homage—the application of their names to the lands discovered.

A fellow-explorer, the English sailor George Powell, fittingly honored his American comrade by charting "Palmer Land" on his map of South Shetlands, 1822 (reproduced, Balch, "Antarctica," page 96), which nomenclature was promptly accepted in French official publications ("Annales Maritimes et Coloniales," Paris, 1824).

The just and accurate use of Palmer Land continued on the charts of the world until, in 1831, it was displaced by potent authorities. The Enderby brothers, of Great Britain, one of whom was an influential Fellow of the Royal Geographical Society, fitted out an expedition under command of John Biscoe, a retired master of the Royal Navy, who visited the coasts of Palmer Land, whence resulted its replacement by Graham Land, renamed after the first Lord of the Admiralty, Sir James R. G. Graham.

The combination of the British government, of the Royal Navy, and of the Royal Geographical Society was overpowering, so that the name of the American captain disappeared from Antarctic charts, of which England then had a practical monopoly. The potency of the authority of the "mistress of the seas" and the insidious effect of this act of suppression and unjustifiable substitution can be traced through the geographic literature of the past 80 years. The *Encyclopedia Britannica*, 9th edition, 1875, mentions neither Palmer nor charts his discoveries.

Nor has the influence of such suppression been confined to Europe, as its effect has been often noted in this country. In March, 1912, one of the best-edited and most reliable of American newspapers published a long and detailed summary of Antarctic explorations, widely copied, in which neither the name nor the work of the discoverer of Antarctica is even mentioned. On the contrary, to the Russian explorer Bellingshausen is indirectly ascribed the honor which pertains to an American sailor.

One English author, Dr. Hugh Robert Mill ("Siege of the South Pole," 1905, page 162), expresses the opinion that "as a matter of historic justice it seems to us that Powell's name of Palmer Land ought to be retained," an opinion inseparable from any careful consideration of the facts.

The standard British authority for south-polar work is *The Antarctic Manual*, specially compiled for the governmental expedition of 1901, commanded by Captain R. F. Scott, R. N. It reproduces on its charts the tracks and discoveries of all the British whalers, including Biscoe, who appropriated Palmer's work. It omits from the charts Palmer's name, although the contribution of the Belgian professor, Arctowski, to the manual mentions Palmer Land in text and by sketch map.

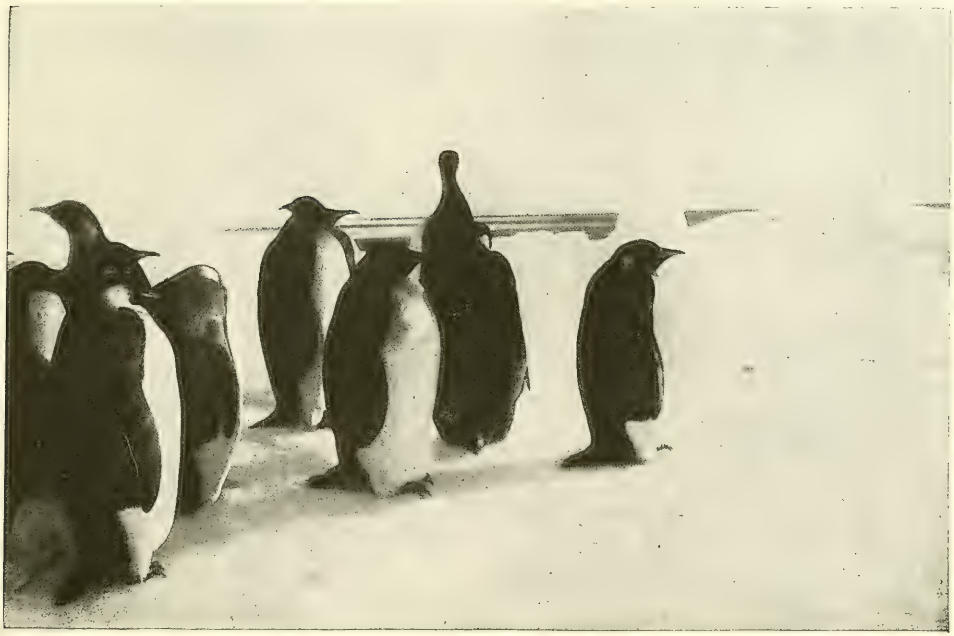
A concession is made in the *Encyclopedia Britannica*, 11th edition, 1911, specially Americanized for the United States, which admits in two lines that "Nathaniel Brown Palmer discovered the mountainous *archipelago* which now bears his name." It then proceeds to give a column regarding John Biscoe, R. N., whose explorations, as above recited, displaced Palmer Land in favor of Graham *Land*.

Has not the time arrived when the glorious phase of American maritime history should receive full national recognition? Every text-book teaching polar geography should contain the statement that the American captain, N. B. Palmer, first discovered parts of the continent of Antarctica, and on every official south-polar map should be replaced Palmer Land.

ANTARCTIC DISCOVERIES BY LIEUTENANT CHARLES WILKES, U. S. NAVY

We pass now to the American who discovered widely separated points of Antarctica. Realizing with scientific acumen their interrelations, he correctly

EMPERORS ON THE MARCH



Photos by Sir Ernest H. Shackleton
From "The Heart of the Antarctic," by E. H. Shackleton (J. B. Lippincott Co.)

EMPERORS AT REST

designated the new regions as the Antarctic Continent.

The Wilkes expedition for maritime exploration was authorized by an act of Congress approved May 18, 1836. As organized, it consisted of five unsuitable and inadequately equipped ships, of which the largest was the flagship *Vincennes* and the smallest the *Flying Fish*, 96 tons. The command was refused by several officers, but late in 1838 the squadron sailed under Lieut. Charles Wilkes, U. S. Navy. Scientific work was strictly subordinated to surveys and explorations, it being a commercial enterprise.

The official instructions of the Secretary of Navy, Paulding, August 11, 1838, ran in part as follows:

"You will proceed to explore the southern Antarctic to the southward of Powell's group, and between it and Sandwich Land, endeavoring to reach a high southern latitude, making such examination and surveys of the bays, ports, inlets, and sounds in that region (Tierra del Fuego) as may be serviceable in future to vessels engaged in the whale fisheries.

"From Sydney (at the end of 1839) you will make a second attempt to penetrate within the Antarctic region, south of Van Dieman's Land, and as far west as longitude 45° E., or to Enderby Land. The Congress of the United States, having in view the important interests of our commerce embarked in the whale fisheries and other adventures in the great Southern Ocean, by an act of the 18th of May, 1836, authorized an expedition to be fitted out for the purpose of exploring and surveying that sea.

"Although the primary object of the expedition is the promotion of the great interests of commerce and navigation, yet you will take all occasions not incompatible with the great purposes of your undertaking to extend the bounds of science and promote the acquisition of knowledge.

"You will prohibit all under your command from furnishing any person not belonging to the expedition with information which has reference to the objects or proceedings of the expedition."

While no mention was made of Palmer's discoveries, they were well known to Wilkes, who made Orange Harbor, Tierra del Fuego, his base of operations. With the *Porpoise* and *Sea Gull* he explored to the east. Leaving South Shetlands to the north on March 3, 1839, Wilkes reports: "Filled away at daylight, and stood for Palmer Land. . . . At 6:30 we made land, which I took to be Mount Hope, the eastern point of Palmer Land. . . . Near to us we discovered three small islets, and gave them the name of Adventure Islets, while beyond and above all rose two high mountains, one of which was Mt. Hope."

Violent gales and thick ice obliged a speedy return.

Meanwhile Captain Hudson, in the *Peacock*, and Lieutenant Walker, in the *Flyish Fish*, struggled southwestward from February 25 to March 25, with gales and fogs. Appearances of land (unconfirmed) were noted from about 70° 20′ S., 100° W.

The next Antarctic cruise was made from Sydney, Australia, the designated base. Wilkes sailed December 26, 1839, with the flagship *Vincennes*, the *Peacock*, the *Porpoise*, and the tiny pilot-boat *Flying Fish*.

This memoir does not concern the dangers and privations incident to this astonishing Antarctic cruise, from which one ship returned almost as by miracle. Nevertheless, unfitness of ships, insufficiency of clothing, inappropriate food, inclemency of weather, extraordinary ice conditions, and difficulties of navigating sailing ships in the ice form a background against which stand out brilliantly the indomitable character of the commander, the courage, seamanship, and resourcefulness of the officers and men. Attention is here given only to discoveries.

This account is drawn from Wilkes' narrative, and quotations are from the reports of proceedings by the ships named.

January 16, 1840. "Appearances believed to be land were visible from all three vessels."*

*The *Flying Fish* was absent. The land signs are surmised to have been the loom of the Balleny Islands, discovered the previous January, but unknown to Wilkes.

January 19, 1840. "In the morning we (*Vincennes*) found ourselves in a deep bay. Land was now certainly visible, both to the south-southeast and southwest, in the former direction most distinctly. Both appeared high."

At three the same morning Hudson, in the *Peacock,* tacked to reach "An immense mass which had every appearance of land, seen far beyond and towering over an ice island. It bore southwest and had the appearance of being 3,000 feet in height, looking gray and dark, and divided into two distinct ridges throughout its entire extent; the whole being covered with snow."*

January 22, 1840. "The *Peacock* stood into the (Peacock) bay and saw the same appearance of high land in the distance. Sounded; bottom was reached at 320 fathoms; the matter brought up was slate-covered mud." (The bay, 20 miles deep, was surrounded by an ice-barrier.)

January 23, 1840. The *Vincennes* entered an indentation in the ice-barrier, which stretched unbroken along their course.

"The appearance of land was observed both to the eastward and westward. . . . Reached the solid barrier. This was a deep indentation in the coast, about 25 miles wide; explored it to the depth of 15 miles. This I have called Disappointment Bay; it is in latitude 67° 4′ 3″ S., longitude 147° 30′ E" (see map, page 308).

January 28, 1840. The *Vincennes* at 9.30 a. m. "had another sight of land ahead. (11 a. m.) We had the land now in plain view." A violent gale obliged the ship to put to sea.

January 30, 1840. From the *Vincennes* "land was in sight. At 8 o'clock reached the icy barrier and hove to. It was tantalizing, with the land in sight, to be again and again blocked out. . . . This bay was formed partly by rocks and partly by ice islands. . . . We approached within half a mile of the dark volcanic rocks, which appeared on both sides of us, and saw the land gradually rising beyond the ice to the height of 3,000 feet, and entirely covered with snow. . . . I make this bay (called Piner) in longitude 140° 2′ 30″ E., latitude 66° 45′ S.; and now that all are convinced of its existence, *I gave the land the name of the Antarctic Continent.* . . . Sounded and found a hard bottom at 30 fathoms."

Driven from Piner Bay by a gale, Wilkes continued his cruise along the unbroken ice-barrier to the westward. This, in despite of the official report of his medical officers, endorsed by a majority of his line officers, that "a few days more of such exposure . . . would reduce the number of the crew by sickness to such an extent as to hazard the safety of the ship and the lives of all on board."

February 2, 1840. The *Vincennes* in 137° 2′ E., 66° 12′ S., at 3 p. m., had "land in sight, with the same lofty appearance as before. No break in the icy barrier, where a foot could be set on the rocks."

February 6, 1840. From the *Vincennes* the barrier "still had the appearance of being attached to the land, and in one uninterrupted line."

February 7, 1840. The *Vincennes* "continued all day running along the perpendicular icy barrier, about 150 feet in height. Beyond it the outline of the high land could be well distinguished. At 6 p. m. we found the barrier suddenly trending to the southward. . . . This point I have named Cape Carr, in longitude 131° 40′ E., latitude 64° 49′ S."

February 8, 1840. The *Vincennes* at noon was in 127° 7′ E., 65° 3′ S. "At 7 p. m. we had strong indications of land; the barrier was of the former perpendicular form, and later the outline of the continent appeared distinct though distant."

February 12, 1840. From the *Vincennes* at 1 p. m.: "Land was now distinctly seen from 18 to 20 miles distant,

*Admiral John E. Pillsbury, U. S. Navy, conclusively proves (National Geographic Magazine, February, 1910, pp. 171–173) from D'Urville's reports that his discovery of Adélie Land was one day after Wilkes discovered Cape Hudson. D'Urville used the date of America, and Wilkes that of Europe, so that D'Urville's January 21 was in reality January 22.

Photo by Sir Ernest H. Shackleton
From "The Heart of the Antarctic," by E. H. Shackleton (J. B. Lippincott Co.)

DIGGING TO ASCERTAIN THE DEPTH OF SNOW COVERING A DEPOT LEFT BY A PREVIOUS EXPEDITION

bearing from south-southeast to southwest—a lofty mountain range, covered with snow, though showing many ridges and indentations. . . . The barrier in places had the appearance of being broken up, and we had decreased our longitude to 112° 16′ 12″ E., while our latitude was 64° 57′ S. This put the land in about 65° 20′ S., and its trending nearly east and west."

February 13, 1840. The *Vincennes* "in the afternoon had the land ahead. At 6.30 p. m. it was judged to be 10 or 12 miles distant. The day was remarkably clear and the land very distinct. By measurement we made the extent of coast of the Antarctic Continent, which was then in sight, 75 miles, and by approximate measurement 3,000 feet high. It was entirely covered with snow. Longitude at noon, 106° 18′ 42″ E., latitude 65° 49′ 40″ S. . . . Hove to. Fortunately made a landing (on an ice island). We found imbedded in it boulders, stones, etc. There was no doubt that it had been detached from the land, which was about 8 miles distant."

Wilkes turned back when in about 97° 40′ E. longitude, 64° 1′ S. latitude, having traced for 1,700 miles a practically uninterrupted ice-barrier, bordering the coast of his Antarctic Continent.

The *Vincennes* proceeded first to Hobart Town, then to Sydney, which it reached on March 11. Lieutenant Wilkes immediately announced the discovery of a South Polar Continent to the Secretary of the Navy in the following letter, dated at Sydney, New South Wales, March 11, 1840:

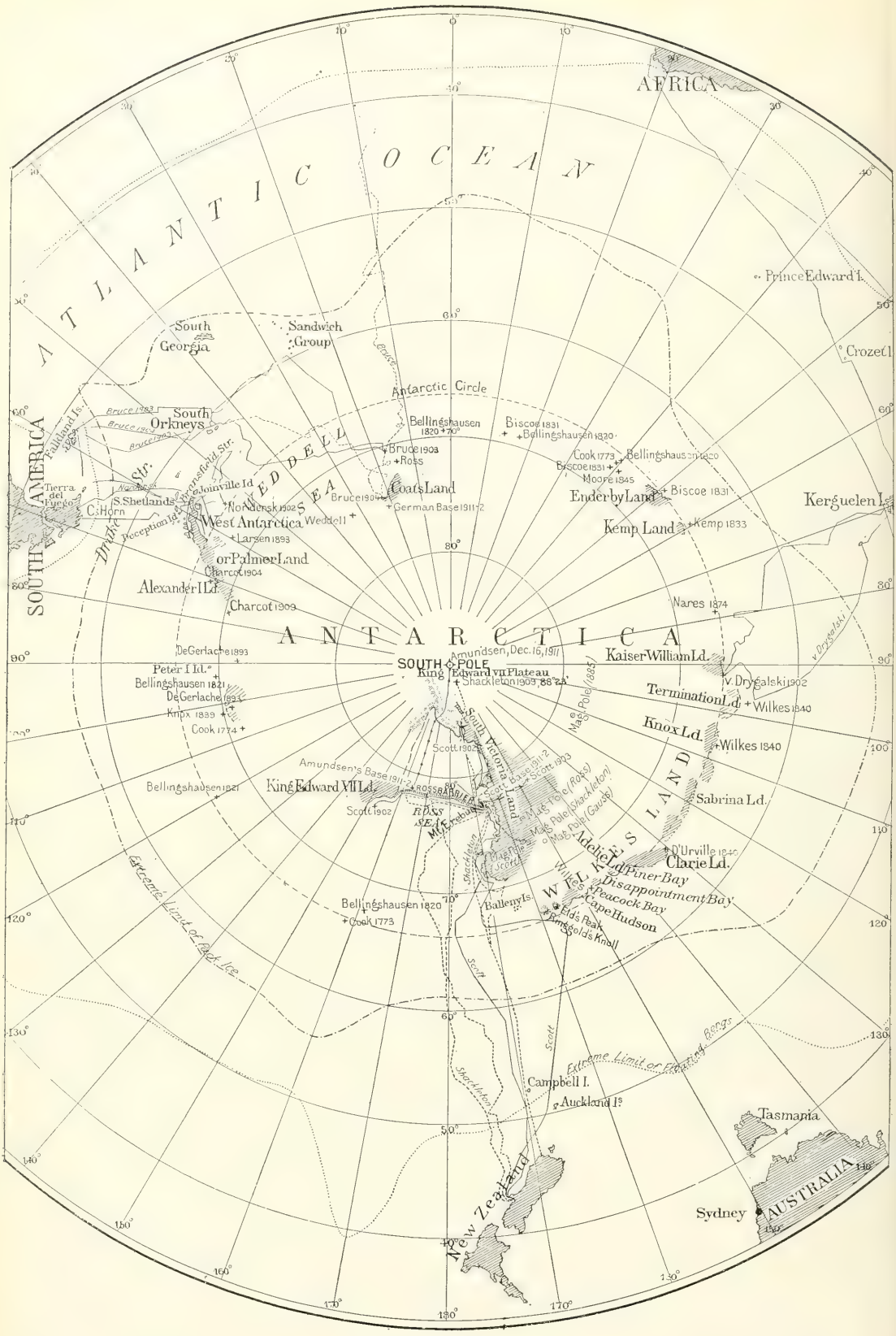
"It affords me much gratification to report that *we have discovered a large body of land within the Antarctic circle, which I have named the Antarctic Continent,* and refer you to the report of our cruise and accompanying charts, inclosed herewith, for full information relative thereto."

Mr. Edwin S. Balch, in his learned and exhaustive memoir on south-polar explorations (*Antarctica,* Phila., 1902) most concisely and justly summarized the geographical outcome of this cruise in the statement: "The cruise of Wilkes will remain among the remarkable voyages of all time. No finer achievement has been accomplished in the annals of the Arctic or of the Antarctic. With unsuitable, improperly equipped ships, amid icebergs, gales, snowstorms, and fogs, Wilkes followed an unknown coast-line for a distance exceeding in length the Ural Mountain range. It is the long distance which Wilkes traversed which makes the results of his cruise so important; for he did not merely sight the coast in one or two places, but he hugged it for such a distance as to make sure that the land was continental in dimensions. . . . It is only the exact truth to assert that the honor of recognizing the existence of the continent of Antarctica belongs to Charles Wilkes and to the United States Exploring Expedition."

DISCOVERIES OF WILKES DISCREDITED

On his announcement of the existence of the Antarctic Continent, Wilkes naturally expected an appreciative acknowledgment and high commendation—from his own countrymen at least. Instead his experiences were practically parallel with those of Columbus. Placed in arrest, he was tried for his commission under charges alleging cruelty, falsehood, grave misconduct, and of scandalous acts—such, for instance, as wearing the uniform of a captain while yet a lieutenant. After a long and exhaustive trial he was fully and honorably acquitted, though he suffered from the chagrin and temporary stigma incident to such official investigations. Though reëstablished in public opinion at home, he was subject to attacks and innuendoes from abroad to the day of his death.

By extending an unexpected favor Wilkes gained an enemy. Contrary to his stringent official instructions, he sent to Capt. J. C. Ross, R. N., then engaged in Antarctic research, a chart and letter showing his own experiences and discoveries. This officer of the Royal Navy not only reflected severely on Wilkes (Ross: "Voyage to the South Seas," 1847, I:272, 280, 285-299), but omitted all of his discoveries from the admiralty chart, on which appeared those of every British sealer.



OUTLINE MAP OF ANTARCTIC REGIONS, SHOWING EXPLORATIONS OF THE AMERICAN DISCOVERERS OF THE CONTINENT, PALMER AND WILKES (SEE PAGES 300, 304, 305, AND 307)

His brilliant successes in Arctic and in Antarctic explorations place Ross in a class by himself in polar annals. But unwisely he derogated from his glory by unjustly attributing to Wilkes a dishonorable intrusion on this field of work in 1840. As Wilkes was acting under official orders of 1836, this was clearly an unfounded aspersion which ultimately resulted in the condemnation of Ross' action by competent critics in England, France, and America.

Wilkes, in his "Synopsis of Cruise," 1842, clearly says that on the chart sent to Ross was "laid down land not only where we had determined it to exist, but those places in which every appearance denoted its existence," as was natural in a chart for information. Ross declined this explanation, and then unfortunately charted himself the Parry Mountains, which are non-existent (Scott: "Voyage of the Discovery," I: 171).

Thus it was Ross, not Wilkes, who appropriated other men's discoveries, for three of Ross' new islands are only three peaks of Balleny's Sturge Island (Scott: "Voyage of the Discovery," II:389).

The discrediting of Wilkes by standard English authorities has been bold, open, and persistent for 70 years, though occasionally in late years some able, impartial expert, like the Scotch scientist, Sir John Murray, has expressed belief in him.

The *Encyclopedia Britannica,* 9th edition, 1875, says of Wilkes' discovery of the southern continent: "As a portion of it had already been seen by Balleny and the rest of it has since been proved not to exist, the claim has not been admitted." Balleny's mate, John McNab, however, when in 65° 10′ S., 117° 4′ E., on March 3, 1839, records in his journal, "To the southwest the ice was quite fast, with every *appearance* of land at the back of it, but the weather coming on thick." And on this indefinite statement British geographers locate Sabrina Land and declare it to be *known* land.

In 1897, in his anniversary address to the Royal Geographical Society, its president, Sir Clements Markham, claimed that Sir James Clark Ross, R. N., "made one of the greatest of geographical discoveries of modern times, amid regions of perpetual ice, *including a southern continent.*"

In 1899 Markham read before the International Geographical Congress at Berlin a paper, "The Antarctic Expeditions," in which he omitted the names of Wilkes and Palmer. Moreover, he proposed to divide the Antarctic region into four quadrants, and to name each quadrant after an eminent Britisher. He eliminated Wilkes' discoveries and proposed to call the region which Wilkes had explored "Victoria Quadrant," thus ignoring the prior and brilliant work of the great Antarctic French explorer, Dumont D'Urville, as well as that of the American.

The Antarctic Manual, 1901, compiled for the British National Antarctic Expedition of that year, omits from its official chart all of Wilkes' discoveries except Knox Land.

The 30-inch British terrestrial globe, by W. and A. K. Johnson, corrected to 1903, omits all of Wilkes' work.

Capt. R. E. Scott, R. N., in his "Voyage of the Discovery," 1905, states of his own cruise: "Thus once and for all we have definitely disposed of Wilkes Land," and so omits it from his chart, retaining Sabrina Land, however, of Balleny.*

With unconscious inconsistency Scott admits that "Wilkes' soundings still remain as a guide to the limit of the continental plateau," thus indirectly assuming that Ross discovered the austral continent.

Dr. Mill, "Siege of the South Pole," 1905, indefinitely admits that Wilkes discovered something, but does not directly name any land. Ignoring entirely the official chart of Wilkes, Mill gives a misleading impression by reproducing without explanation the preliminary chart sent to Ross (Balch: Antarctica, 1902). Sir Ernest Shackleton accepts Scott's erroneous statement about sailing "over part of the so-called Wilkes Land," "The Heart of the Antarctic," page 229, and omits it from his chart (except Knox

* Mr. Edwin Swift Balch, in his "Why America Should Re-explore Wilkes Land," p. 39, etc., shows that Scott never reached Wilkes Land.

THE NOME EXPRESS READY TO START

Photo by Beverly B. Dobbs, Nome

The records made by dog teams in Alaska are extraordinary. On one occasion recently, Mr. A. D. Nash, of California, went from Dawson to Nome, a distance of 1,400 miles, in 26 days of travel, or an average of 44 miles a day. He made a trip the same year from Candle Creek to Nenkulk, a distance of 102 miles, in 17 hours, hauling a lady passenger and the mail. In the races of the Nome Kennel Club of Alaska the winning dog team has made the 412-mile course from Cripple Creek to Nome in 82 hours and 2 minutes, or an average of 121 miles a day. John Heston, with his own dog team, traveled from Valdez, Alaska, to Cape Nome, a distance of over 1,100 miles, in 23 days, or an average of more than 49 miles per day.

A RACING TEAM: CAPE NOME, ALASKA

Photo by Beverly B. Dobbs, Nome

Amundsen, on his journey to the South Pole, averaged 15½ miles per march. On his return he averaged 22 miles, on one march making 31 miles. No previous explorer in the south has made distances like these. Peary's average on his return from the North Pole to land was 25.6 miles. On one of his earlier expeditions Peary made the distance from Cape Wilkes to Cape D'Urville, a distance of 65 miles, in one march. He repeatedly made distances of 40 miles in one march, and in the winter of 1899-1900 traveled from Etah to a point in Robertson Bay, 60 miles distant, in less than 12 hours. On the Greenland ice-cap he once averaged 20 miles a day for 25 successive marches, and on another occasion he averaged 30 miles a day in seven successive marches. Macmillan and Borup, members of the last Peary expedition, returning from Cape Morris Jessup to the *Roosevelt,* made the distance of 250 miles in eight marches, an average of over 31 miles a march.

Photo by Sir Ernest H. Shackleton
From "The Heart of the Antarctic," by E. H. Shackleton (J. B. Lippincott Co.)

KILLER WHALES SOUNDING OFF THE GREAT ICE BARRIER

Land), but sympathizingly adds, "The question of the existence of this land in any other position had been left open."

The first break in nearly fourscore years of misrepresentation in British standard works is in the *Encyclopedia Britannica,* 11th edition, 1911, where Dr. Mill admits "there can be no doubt that Wilkes saw land along the line where Adélie Land, Kemp Land, Enderby Land are known to exist, even if the positions he assigns are not quite accurate."

THE CONTINENT OF ANTARCTICA

Probably no other standard authority denies the existence of a south-polar continent save the *Encyclopedia Britannica,* 11th edition, 1911, which mentions "Australia, the *only* continent entirely in the southern hemisphere." The 10th edition, 1902, said: "The hypothesis of a great Antarctic continent, or continental archipelago, continuously covered by an ice-sheet, is confirmed by the observations of recent explorers, but the evidence is not yet direct or conclusive."

Nearly 40 years since, a distinguished scientist, born on the continent of North America, Sir John Murray, of *Challenger* expedition and fame, and one of the eight honorary members of the National Geographic Society, considered the mooted extent of south polar lands and finally outlined their logical continental form as the continent of Antarctica—a fitting and largely accepted name. This great feat of constructive geography depended on a few-score handfuls of oceanic ooze from the south-polar seas and scanty bits of rocks from scattered lands.

Whatever doubts remained as to the accuracy of Murray's deductions have disappeared since the cumulative discoveries of Amundsen, Borchgrevink, Bruce, Drygalski, Gerlache, Larsen, Nordenskiöld, Scott, and Shackleton. Indeed, a German scientist has calculated that Antarctica is considerably greater in area than Europe, and that the average elevation is more than double that of Asia.

CONCLUSION

It has been shown that the primary discovery of Antarctica and its definite recognition as a continent were the outcome of American energy and prescience. It is therefore the duty of the 120,000 members of the National Geographic Society to create a public sentiment that shall honor in our literature and in our history the achievements of Nathaniel B. Palmer and of Charles Wilkes.

VOL. XXIII, No. 4 WASHINGTON APRIL, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

TAAL VOLCANO AND ITS RECENT DESTRUCTIVE ERUPTION

By Dean C. Worcester

Secretary of the Interior of the Philippine Islands

DISTANCE detracts amazingly from public appreciation of the magnitude of great calamities, and as the people of the United States have thus far gained their information relative to the recent great eruption of Taal Volcano chiefly, if not entirely, from meager newspaper reports, it is not strange that few of them even now realize that in the early morning of January 30, 1911, there occurred in the Philippine Islands an appalling disaster.

The destructive eruption of Taal Volcano which then took place is by no means its first outbreak within historic times. Taal is an old offender in this regard and we know that it was making trouble soon after the discovery of the Philippine Islands.

The town of Taal was founded by Augustinian friars in 1572, and in his description of this event Father Gaspar de San Agustin says that in Lake Bombon, on the south shore of which the town was located, "there is a volcano of fire, which is wont to spit forth many and very large rocks, which are glowing and destroy the crops of the natives."

The volcano was unquestionably very active at this time. In fact, Father Nada has stated that Taal was actually in eruption in 1572. No details of this eruption were recorded, so far as is now known, but it is certain that Father Albuquerque celebrated mass on Volcano Island with a view to tranquil the spirits of the panic-stricken natives.

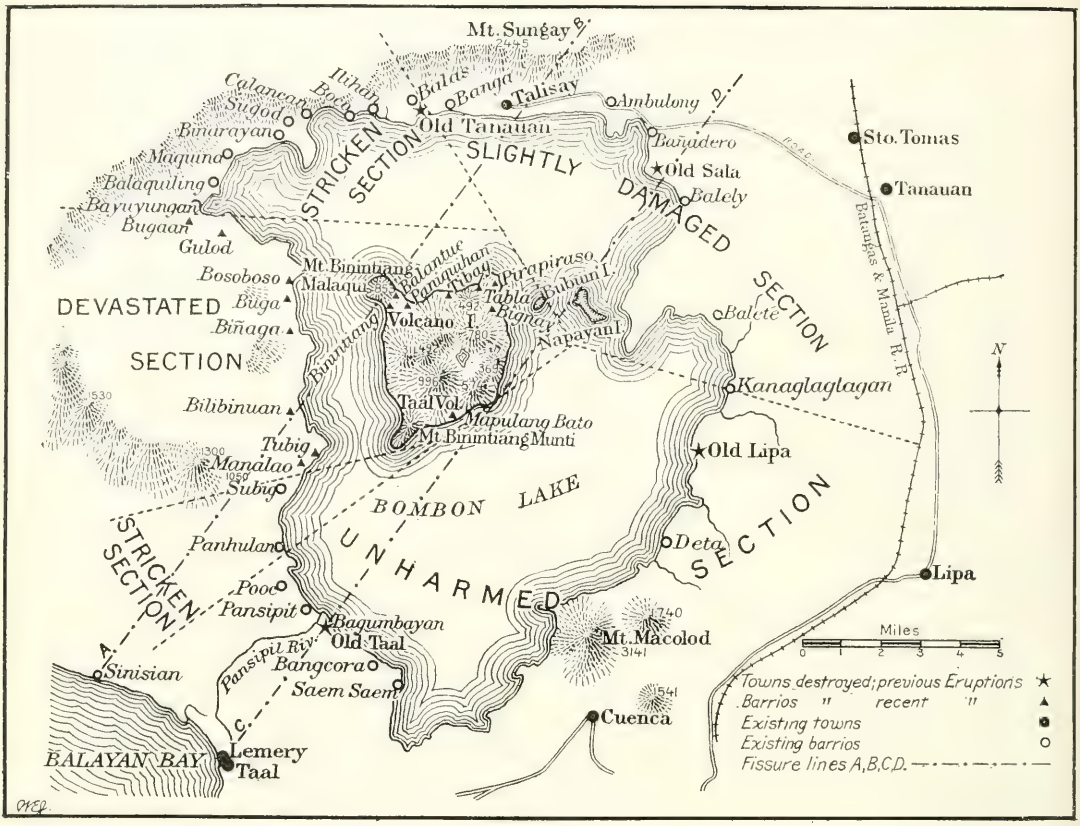
In 1591 Father Alcantara performed a similar ceremony, because the volcano had begun to belch forth extraordinary masses of smoke.

Between 1605 and 1611 Father Tomás de Abreu not only said mass on the volcano, but had an immense cross of hard wood erected at the brink of the principal crater, for the reason that from this crater there had come frequent subterranean rumblings which had greatly terrified the inhabitants of neighboring villages.

In several chronicles there exist vague statements concerning eruptions in 1634 and in 1635.

In 1707 there occurred the first well-established and authentically recorded eruption. At this time a cone, which still exists and is called Binintiang Malaqui (see page 318), "burst forth with a tremendous display of thunder and lightning; but aside from fear and tremblings no damage was done in the towns situated on the shores of Lake Bombon." *

*The translations of the accounts of early eruptions are taken from the Rev. Miguel Saderra Maso's paper on "The Eruption of Taal Volcano on January 30, 1911."



MAP SHOWING AREA OF DEVASTATION BY THE LAST ERUPTION OF TAAL VOLCANO, AND ALSO THE TOWNS DESTROYED BY PREVIOUS ERUPTIONS

On September 24, 1716, there occurred a violent eruption, which has been described by Father Manuel de Arce as follows:

FISHES COOKED BY THE BOILING LAKE

"On September 24, 1716, at about 6 o'clock in the evening, a great number of detonations were heard in the air, and shortly after it became plain that the volcano in Lake Bombon had burst on its southeastern side, which faces Lipa, so that the whole point called Calauit appeared to be on fire. Later on the eruption seemed to spread into the lake, in the direction of Mount Macolod, which rises opposite the volcano on the southeastern shore of the lake. Great masses of smoke, water, and ashes rushed out of the lake, high up into the air, looking like towers. Simultaneously there was a great commotion in the earth which stirred up the water in the lake, forming immense waves which lashed the shores as though a violent typhoon were raging. Their fury was such that in front of the Convento of Taal, and in other places of the beach, a strip of more than 10 brazas [16.7 meters] in width was engulfed by the water, and the church was endangered.

"On the following days, Thursday, Friday, and Saturday, things continued in the same way, but by Sunday all the combustible material appears to have been consumed. This eruption killed all the fishes, large and small, the waves casting them ashore in a state as if they had been cooked, since the water had been heated to a degree that it appeared to have been taken from a boiling caldron. There was an all-pervading, pestilential stench of sulphur which greatly molested the inhabitants of the towns surrounding the lake.

"Sunday morning the sun broke

MAP OF THE REGION AFFECTED BY THE GREAT ERUPTION OF JANUARY 30, 1911

The inner line incloses the area of devastation. The space between it and the next outer line shows the area of serious damage. The space included within the outermost line marks the area over which there was a considerable fall of "ash." A light fall of "ash" extended as far north as Manila and to a corresponding distance in other directions. The lighter ejecta were drifted to the northeast by the wind which prevailed at the time. The loss of life was confined to Volcano Island and to the mainland to the west included within the zone of devastation (see page 361).

through, but later torrential rains fell with thunder and lightning, some of the latter striking and the whole causing the greatest terror. Finally, however, the weather cleared, and of the whole tragedy there remained no other signs than the stench of sulphur and of the great quantity of dead fish cast upon the beach by the waves."

In 1729 there occurred an eruption, of which we have no adequate description.

In 1731 the volcano again burst forth. Father Torrubia has described this outbreak as follows:

"With terror we heard during one of the nights a continuous fire of heavy artillery, as if two mighty armies were engaged in battle. This was followed by a terrible earthquake of long duration, after which we heard only isolated detonations, not with the former frequency, but very much sharper. Their persistency caused us to pass the following day in considerable anxiety and fear. At nightfall we were informed that out of the depths of Lake Bombon, which is at a distance of eight leagues [34 kilometers, or 21 miles] there rose such a frightful and all-devouring conflagration that the whole region was panic-stricken.

"Curiosity led me to go and examine the terrible phenomenon which lasted during many days, accompanied by subterranean rumblings which caused the entire region to tremble. The moment when a report was heard, there appeared in the air, surrounded by sulphurous flames and pestilential smoke, enormous boulders, which built up an island from the bottom of the deep lake, said island

DISTANT VIEW OF TAAL VOLCANO FROM THE SOUTHWEST: BOMBON LAKE, SOMETIMES CALLED TAAL LAKE, IN THE FOREGROUND

having a diameter of one mile, more or less. After the conflagration had become extinct, I myself saw this island from a place near Tanauan. It is composed entirely of rocks with an admixture of other materials ejected during the eruption, without any earth whatever. The rocks, subject to the action of fire ever since their formation, clearly reveal the hand which placed them there. This all-consuming fire made the water boil, cooked the fishes, and left the impress of its fierceness on the very rocks."

In spite of the violence of this eruption, no damage was done to the neighboring towns.

On August 11, 1749, there began a very violent outburst. It has been most graphically described by an eyewitness, Father Buencuchillo, who says:

PYRAMIDS OF ASHES

"During the night of that day the top of the mountain burst out with tremendous force from the same crater which since ancient times used to emit fire and rocks. The course of events was this: At about 11 o'clock of the night I had noticed a rather extensive glare over the top of the island; but entirely unaware of what this might portend, I paid no special attention to it and retired to rest. Around 3 o'clock in the morning of the 12th, I heard something like heavy artillery fire and began to count the reports, taking it for granted that they came from the ship which was expected to arrive from New Spain [Mexico] and which, according to an ancient custom, on entering Balayan Bay saluted Our Lady of Caysasay. I thought it strange, however, when I found that the number of detonations already exceeded one hundred, and still they did not cease. This caused me to rise with some anxiety as to what could be the matter; but my doubts were quickly dispelled, as at this moment there appeared four excited natives who shouted: 'Father, let us leave this place! The volcano has burst out and all this noise and racket comes from it!'

"By this time it began to dawn, and we saw the immense column of smoke which rose from the summit of the island, while several smaller whiffs issued from other openings. I confess that the spectacle, far from frightening me, rather delighted my eyes, especially when I noticed that also from the water there arose enormous columns of sand and ashes, which ascended in the shape of pyramids to marvelous heights and then fell back into the lake like illuminated fountains.

"Some of the pyramids surged toward north, others toward east, the sight lasting until 9 o'clock of the morning. At the latter hour there was felt a furious earthquake which left nothing movable in its place within the convento. This forced me to flee to higher ground, especially as I noticed that some of the horrid pyramids shooting forth from the water were coming toward the town and place where we were. When they reached that part of the lake's shore which was known as 'tierra destruída' [waste land?], they ruined that tract entirely, and with a second earthquake, not less fierce than the one shortly preceding, it sank into the lake. To this very day, the branches of the trees buried beneath the water can be seen from the distance.

"During these terrible convulsions of the earth fissures opened in the ground amid horrifying roars, said fissures extending from the northern and northeastern beach of the lake as far as the neighborhood of the town of Calamba. Here, as well as elsewhere, the whole shore of Lake Bombon has been disturbed. The entire territory of Sala and part of that of Tanauan have been rendered practically uninhabitable; the water-courses have been altered, former springs have ceased to flow and new ones made their appearance; the whole country is traversed by fissures, and extensive subsidences have occurred in many places.

"During my flight I saw a great many tall trees, such as cocoanut and betelnut palms, either miserably fallen or so deeply buried that their tops were within reach of my hands. I likewise saw several houses which formerly, in accordance with Philippine custom, had their

Photo by Charles Martin

A PEACEFUL NEIGHBOR OF MOUNT TAAL, BININTIANG MALAQUI

This crater, at the extreme northwestern extremity of Volcano Island, "burst forth with a tremendous display of thunder and lightning" in 1707, but it has been quiet ever since (see page 313)

floors raised several yards above ground, but had sunk to such a degree that the same ladder which once served to ascend into them was now used to descend to them. The most remarkable thing about this is that the natives tranquilly continue occupying them, though they find themselves buried alive.

"It rained ashes in considerable quantity, and that part of them which remained suspended in the air formed a vast cloud, which grew so dense as to cause real darkness during the hours of broad daylight."

On May 15, 1754, there began the most violent and long-continued eruption which has occurred within historic times. The same good priest who so tranquilly observed the eruption of 1749 and so graphically recorded his observations witnessed this eruption also, and again his description is most interesting. He says:

"A LIVING PICTURE OF SODOM"

"On May 15, 1754, at about 9 or 10 o'clock in the night, the volcano quite unexpectedly commenced to roar and emit, sky-high, formidable flames intermixed with glowing rocks, which, falling back upon the island and rolling down the slopes of the mountain, created the impression of a large river of fire. During the following days there appeared in the lake a large quantity of pumice-stone which had been ejected by the volcano. Part of these ejecta had also reached the hamlet of Bayuyungan and completely destroyed it.

"The volcano continued thus until June 2, during the night of which the eruption reached such proportions that the falling ejecta made the entire island appear to be on fire, and it was even feared that the catastrophe might involve the shores of the lake. From the said 2d of June until September 25, the volcano never ceased to eject fire and mud of such bad character that the best ink does not cause so black a stain.

"During the night of September 25 the fire emitted was quite extraordinary and accompanied by terrifying rumblings. The strangest thing was, that within the black column of smoke issuing from the volcano ever since June 2, there frequently formed thunder-storms, and it happened that the huge tempest cloud would scarcely ever disappear during two months.

"At daybreak of September 26 we found ourselves forced to abandon our dwelling for fear lest the roofs come down upon us under the weight of ashes and stones which had fallen upon them during that hapless night. In fact, some weaker buildings collapsed. The depth of the layer of ashes and stones exceeded two 'cuartas' [45 centimeters, or 18 inches], and the result was that there was neither tree nor other plant which it did not ruin or crush, giving to the whole region an aspect as if a devastating conflagration had swept over it. After this the volcano calmed down considerably, though not sufficiently to offer any prospect of tranquillity.

"During the night of November 1 Taal resumed its former fury, ejecting fire, rocks, sand, and mud in greater quantities than ever before. On November 15 it vomited enormous boulders, which, rolling down the slopes of the island, fell into the lake and caused huge waves. These paroxysms were accompanied by swaying motions of the ground, which caused all the houses of the town to totter. We had already abandoned our habitation and were living in a tower, which appeared to offer greater security; but on this occasion we resolved that the entire population retire to the sanctuary of Caysasay, only the 'administrador' and myself to remain on the spot.

"At 7 in the evening of November 28 occurred a new paroxysm, during which the volcano vomited forth such masses of fire and ejecta that in my opinion all the material ejected during so many months, if taken together, would not equal the quantity which issued at the time. The columns of fire and smoke ascended higher than ever before, increasing every moment in volume and setting fire to the whole island, there being not the smallest portion of the latter which was not covered by the smoke and the glowing rocks and ashes. All this was accompanied by terrific

lightning and thunder above and violent shocks of earthquakes underneath. The cloud of ejecta, carried on by the wind, extended itself toward west and south, with the result that we saw already some stones fall close to our shore. I therefore shouted to all those who were still in the town to take to flight, and we all ran off in a hurry; otherwise we would have been engulfed on the spot, as the waves of the angry lake began already to flood the houses nearest to the beach.

"We left the town, fleeing from this living picture of Sodom, with incessant fear lest the raging waters of the lake overtake us, which were at the moment invading the main part of the town, sweeping away everything which they encountered. On the outskirts of the town I came upon a woman who was so exhausted by her burden of two little children and a bundle of clothing that she could proceed no farther. Moved by pity, I took one of the toddlers from her and carried him, and the little *indio*, who had been wailing while in the arms of his mother, stopped short when I took him into mine and never uttered a sound while I was carrying him a good piece of the way.

"Having reached a secure place on elevated ground at a distance of about half a league [2 kilometers] from the town, we halted in a hut to rest a little and take some food. From this spot the volcano could be contemplated with a little more serenity of mind. It still continued in full fury, ejecting immense masses of material. Now I also observed that the earth was in continuous swaying motion, a fact which I had failed to notice during the excitement and fear of the flight.

"Shortly afterwards the volcano subsided almost suddenly; its top was clear and apparently calm. We therefore returned on the following day, the 29th, to the town with the intention of surveying the havoc wrought during the preceding night.

"The 29th had dawned calm, but while we were still trying to persuade ourselves that the tragedy was over and the volcano had exhausted its bowels, at about 8 o'clock we heard a crash, and then I noticed that smoke was rising from the point of the island which looks toward east. The smoke spread very gradually as far as the crater of the volcano, while there were many whiffs issuing from points in the direction of another headland. I realized that the island had opened in these places, and fearing that if a crater should open below the water an explosion might follow much more formidable than the preceding ones, I mounted a horse and retired permanently to the sanctuary of Caysasay.

THE SKY WAS SHROUDED IN THE BLACKNESS OF NIGHT FOR THREE DAYS

"Between 3 and 4 o'clock in the afternoon of the said 29th, it began to rain mud and ashes at Caysasay (12 miles from the volcano) and this rain lasted three days. The most terrifying circumstance was that the whole sky was shrouded in such darkness that we could not have seen the hand placed before the face had it not been for the sinister glare of the incessant lightnings. Nor could we use artificial light, as this was extinguished by the wind and copious ashes, which penetrated everywhere. All was horror during those three days, which appeared rather like murky nights, and we did not occupy ourselves with anything but see to it that the natives swept off the roofs the large quantities of ashes and stones which kept on accumulating upon them and threatened to bring them down upon us, burying us alive beneath their weight. But fearing that even these precautions might prove unavailing, we three Europeans—viz., Father Prior, the alcalde, and myself—the only ones who were at the time in the Convento of Caysasay, took refuge on the landing of the stairs as the safest place, and awaited there whatever God might dispose with regard to us. To all this was added incessant thunder and lightning, and it really looked as if the world was going to pieces and its axis had been displaced.

"During the night of the 30th we had not a moment of repose, as every moment we heard the loud crash of houses collapsing under the load of stones, mud,

Photo by Dean C. Worcester

A PORTION OF THE CRATER WALL OF TAAL VOLCANO SHOWING STRATIFICATION

The walls of this crater often show quite bright colors during the rainy season, but turn dingy gray during the dry season (see page 331)

and ashes piled upon them, and feared that the turn of the convento and church of Caysasay would come next. Shortly before daybreak of December 1 there was a tremendous crash, as if the house were coming down over our heads: the roof of the apsis of the church had caved in! Not long afterward the roof of the kitchen gave way with a similar thud. Both were tile roofs.

"The 1st of December broke somewhat clear and our eyes contemplated everywhere ruins and destruction. The layer of ashes and mud was more than five spans [1.10 meters, or 43 inches] thick, and it was almost a miracle that the roofs of the church and convento sustained so great a weight. We caused the bulk of the material to be removed, while new continued to fall on that day and the following, on which latter the direction of the wind changed, carrying the ejecta toward Balayan. On the 3d and 4th we had a formidable typhoon, and thereafter the volcano quieted down.

"Soon afterward I resolved to visit

Photo by Dean C. Worcester

THE ZIGZAG PATH LEADING INTO THE MAIN CRATER OF TAAL VOLCANO (SEE PAGE 331)

Photo by Dean C. Worcester

THE 1904 CRATER IN ACTION

A portion of the temporary red lake shows in the foreground (see page 334)

Photo by Dean C. Worcester

NEAR VIEW OF THE 1904 CRATER

Note the mud flow in the foreground. Note also the pits produced by falling rock (see page 334)

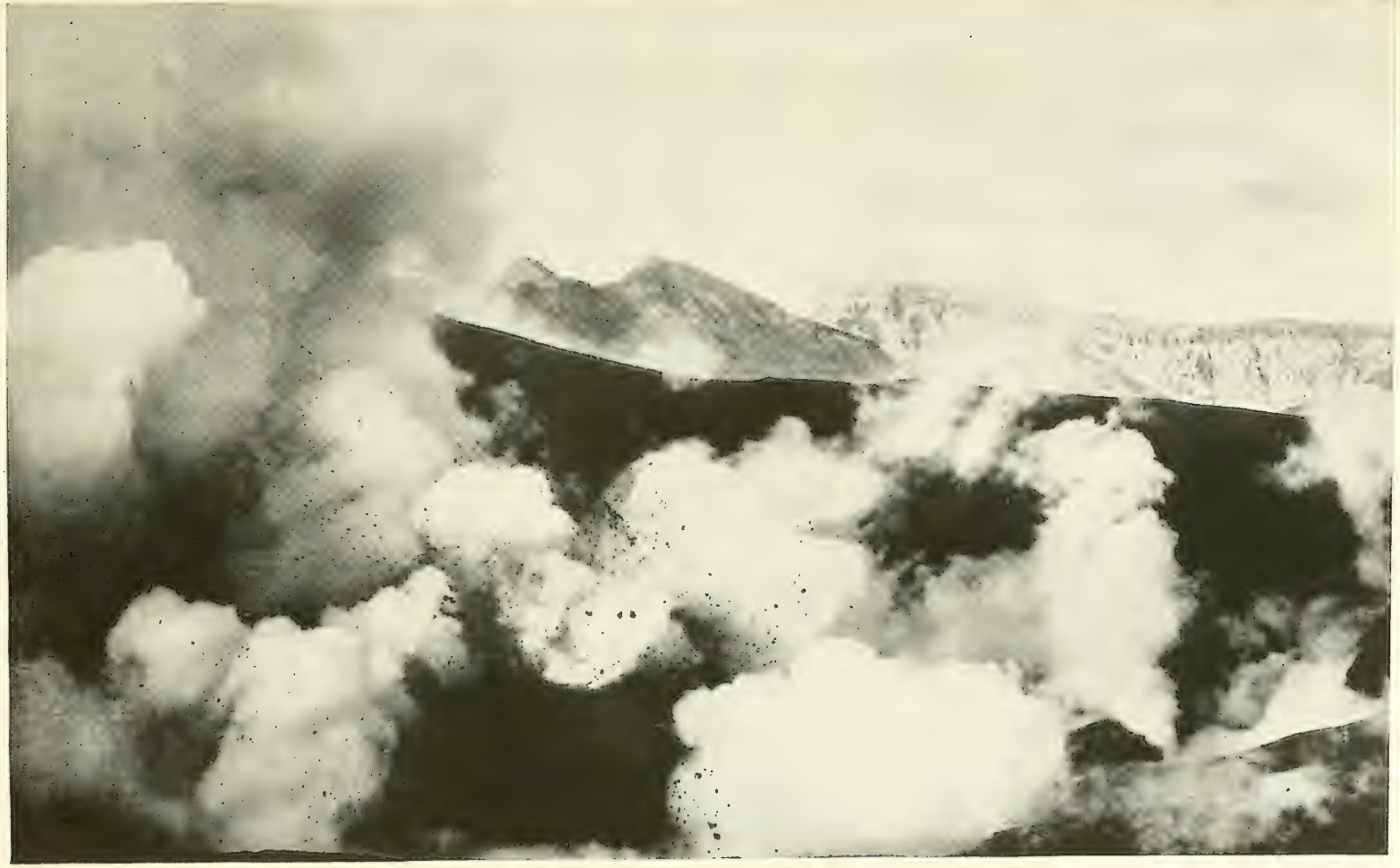


Photo by Dean C. Worcester

VERY NEAR VIEW OF THE 1904 CRATER IN ACTION: NOTE THE BOULDERS BEING EJECTED (SEE PAGE 334)

Photo by Dean C. Worcester

THE 1904 CRATER QUIESCENT (SEE PAGE 334)

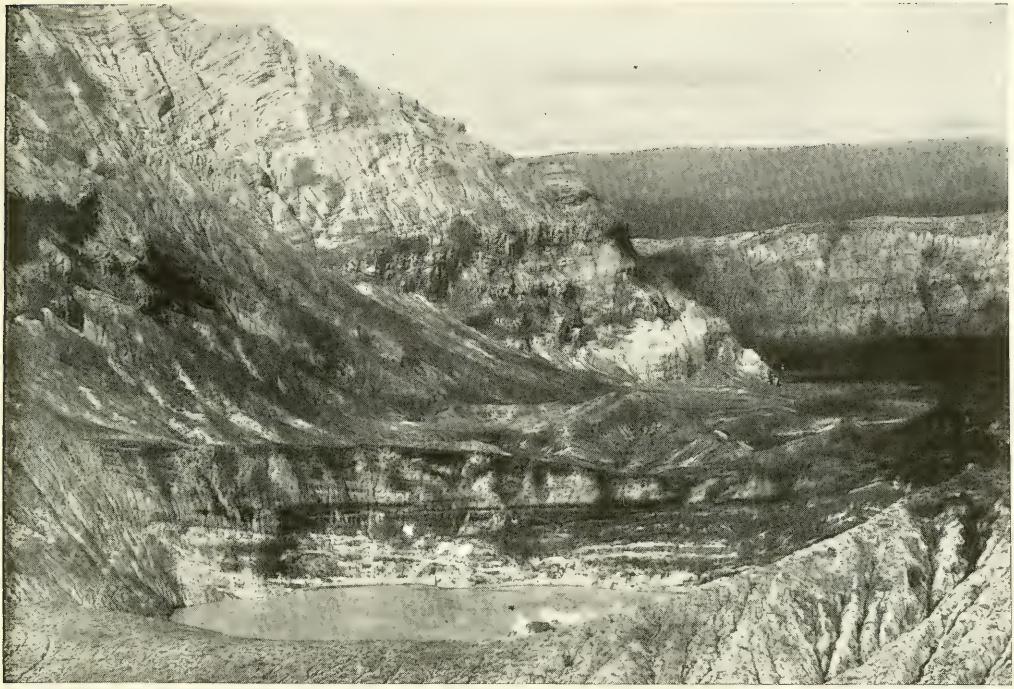


Photo by Dean C. Worcester

LATER: THE 1904 CRATER FILLED WITH WATER

my town of Taal; nothing was left of it except the walls of the church and convento. All the rest, the government house, the walks of the rope factory, the warehouses, everything was buried beneath a layer of stones, mud, and ashes more than 10 spans thick; only here and there could be seen an upright post, the only remnant of a comfortable dwelling. I went down to the river and found it completely filled up, with a boat belonging to the alcalde and many of private persons buried in the mud. After incredible efforts I finally succeeded in unearthing, in what had once been the church and sacristy, the chests which contained the sacred vestments and vessels. Nearly all of them were demolished by the rocks and beams which had fallen upon them and filled with foul-smelling mud that had ruined or disfigured their contents. With the aid of some natives of Bauang I likewise recovered some property from among the ruins of the convento.

"Twelve persons are known to have perished—some carried away by the waves of the lake, others crushed beneath their collapsing houses. Thus the beautiful town of Taal remains a deserted wilderness and reduced to the utmost misery, while once it was one of the richest and most flourishing places. In the villages to the west of the lake, which were the greater and better part, all the houses have either collapsed under the load of material which had been piled upon them or have disappeared completely, swept away by the waves, which in these places were so violent that they dug three ditches or channels, too wide and deep to be forded, and thus rendered impassable the road which joins the town with Balayan. In other parts of the lake shore have likewise opened many cracks and occurred very extensive slides. The worst of all is that the mouth of the river Pansipit having been blocked, the lake is rising and invading the towns of Lipa and Tanauan, both being on the lowest level and inundating their buildings. All the animals of whatever kind have perished, some by being buried, others by drowning, the rest by starving,

Photo by Charles Martin

PANORAMIC VIEW OF TAAL VOLCANO FROM BOMBON LAKE

This photograph was taken during a period of comparative quiet the afternoon before the great eruption, which completely wiped out all trees and grass, leaving the entire island swept perfectly clean (see pages 355 and 356)

as not a green blade remained anywhere.

"The same fate as Taal has befallen the towns of Lipa, Tanauan, and so much of Sala as still existed. These towns, together with Taal, lay around the lake, being situated within easy reach of it and less than one league [4 kilometers] from the volcano. The bulk of the population left this neighborhood and settled in more distant places. Thus out of 1,200 taxpayers, whom Taal contained formerly, hardly 150 remain in the poorest and least respectable villages, which suffered little from the rain of ashes."

This eruption caused the final abandonment of the sites of the old towns of Taal, Lipa, Tanauan, and Sala and the reëstablishment of the first three in new and safer places. The sites of these old towns are shown on the map on page 314.

In this instance the period of activity lasted from the 15th of May until early in December. The titanic energies emanating from this volcanic center were apparently then temporarily exhausted, and there followed a period of quiet lasting until March, 1808, when there occurred an outburst which did much damage to neighboring towns, owing to the great quantity of ejecta. In the vicinity of the volcano there were places where the ground was covered with "ashes" to a depth of some 33 inches. This eruption is said to have modified profoundly the form of the principal crater.

The next serious disturbance occurred on July 19, 1874, when there was an eruption of gases and "ashes" which killed all the live stock on Volcano Island and withered or burned the vegetation on the western slopes of the crater.

Photo by Charles Martin

TAAL VOLCANO FROM BOMBON LAKE THE DAY BEFORE THE GREAT ERUPTION

After taking this photograph, notwithstanding the fury of elements depicted in the illustration, Mr. Martin proceeded to the brink of the volcano to photograph it at close range (see pages 328, 333, and 334).

Photo by Charles Martin

THE THREATENING CLOUD RISING FROM THE CRATER OF TAAL VOLCANO AND DRIFTING ACROSS CAVITE PROVINCE ON THE DAY BEFORE THE GREAT ERUPTION

From November 12 to 15, 1878, there was an eruption during which the entire island was covered with "ashes."

MY FIRST VISIT TO TAAL VOLCANO

My personal acquaintance with Taal Volcano began in June, 1888. While attempting to make the Luzon coast from Mindoro in a small native sail-boat, in company with a fellow ornithologist, Dr. Frank S. Bourns, our frail craft was caught and badly battered in tide rips, and was ultimately dashed upon the coast of the Bay of Batangas.

We made our way overland on foot to the town of the same name, walking into a quicksand after dark and having our shoes pulled off before we could extricate ourselves. When we finally reached our destination, hungry and exhausted, we despatched men to save such portion of our baggage as had not been destroyed, slept the clock around, and then visited the Spanish provincial governor, in order to secure permission to proceed to Manila on a local steamer which was loading with coffee at the pier.

The governor, who was a most kindly man, assured us that we ought not to fail to visit Taal Volcano, even if we had to travel all night in order to get back in time to catch our steamer. We acted on his advice and I have always felt greatly indebted to him for it.

We reached the volcano early the following morning after a rough journey by *carromata* and native boat. The ascent began with one false start, which ended in our being turned back by an impassable fissure, but on our second attempt we reached the rim of the large "old crater" at its lowest point, where it has an elevation of only 369 feet above the waters of the lake.

The view that opened before us was one of unsurpassed grandeur and beauty. We had ascended the eastern slope of the volcano. There lay at our feet a great depression, roughly circular and approximately a mile in diameter. Its walls were in most places nearly, or quite, perpendicular (page 321). They were beautifully stratified and brightly colored. Immediately in front of us was a lunette-shaped fragment of a second crater wall, the remainder of which had long since disappeared.

On the floor of the main crater there were three brilliantly colored lakes, of which the northernmost was blue, the central one yellow, and the southernmost a vivid emerald green. The yellow and green lakes were boiling violently, and from an opening under the southern point of the crater fragment above mentioned there arose, with a steady roar and occasional subterranean explosions, an immense column of steam and sulphur fumes. Numerous solfataras on the floor and sides of the crater spat forth poisonous vapors and contributed assorted hissings to the general chorus of strange and awe-inspiring sounds.

Immediately in front of us the slope of the crater wall was somewhat less abrupt than elsewhere, and we saw extending down to the crater floor traces of a zigzag path (see picture on page 322), said to have been constructed by a love-sick governor to satisfy the caprice of his enamorata, who desired to descend into the crater.

Lured on by that strange impulse which so often leads people into foolish adventures, we scrambled down this apology for a path, finding the main crater floor so hot that we were forced to stand first on one foot and then on the other to keep the soles of our shoes from scorching. We climbed the fragment of the inner crater wall, worked along it to a point immediately above the opening from which was steadily issuing a great column of fumes and steam, craned our necks over the edge and stared down into the seemingly bottomless depths below.

We then retraced our steps and, like the idiots that we were, endeavored to approach one of the boiling lakes in order to secure samples of the water. Soon the ground began to ring hollow under our feet. At this moment one of our Filipino attendants broke through the thin crust on which we were standing and sank to his knees in boiling mud, scalding his legs so that the skin came off. We promptly retraced our steps and climbed up the crater wall, which proved to be a very different undertaking from

Photo by Charles Martin

PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO, LOOKING SOUTHWEST
This photograph was taken the day before the great eruption

descending it. After a brief rest on the rim we reluctantly turned our backs on a view which was then the grandest I had ever seen, and which made a lasting impression on me.

HUGE BOULDERS WERE HURLED SKYWARD

Upon my return to the Philippines, in 1900, I promptly renewed my acquaintance with Taal Volcano, finding the crater little changed, although the discharge of steam and other vapors had temporarily ceased. I believed that a violent eruption was likely to occur at any time, but many others insisted that Taal was dead, or as good as dead. In 1904 I began a series of photographs, which were added to at frequent intervals up to the time of the terrific explosion of January 30, 1911, and which now afford a basis for a study of the changes wrought in the crater not only by the 1911 eruption, but by the comparatively unimportant eruption of July 4-5, 1904, as well.

In April, 1904, a new funnel-shaped crater formed near the base of the southeastern portion of the inner main crater wall. Until July it continually emitted great masses of vapor and intermittently ejected mud and rocks. This unusual activity culminated, on July 4 and 5, in a sharp eruption, which I was fortunate enough to witness, having reached the shore of Volcano Island with a party from the Bureau of Science in the

Photo by Charles Martin

AN EXPLOSION IN THE MAIN CRATER OF TAAL THE DAY BEFORE THE GREAT ERUPTION
This unusual photograph is a splendid tribute to the photographer's courage

midst of a violent wind and rain storm on the evening of the former day.

We found the ascent of the volcano somewhat difficult, as its upper slopes were covered with recently ejected slippery mud. We struggled through this, reaching the crater rim at dusk and being rewarded for our efforts by a magnificent display. An enormous column of steam was rushing from the new funnel-shaped crater (see pages 323-4), and was illuminated by constant lightning flashes.

At frequent intervals there were explosions, which caused the ground to tremble violently, and huge boulders were hurled skyward. As there was little wind at the time, most of these fell back into the crater and rolled to the bottom, where they often momentarily plugged the steam vent, with the result that they were promptly blown into the air again. In fact, ascending boulders not infrequently passed descending boulders in mid-air.

Now and then enormous columns of black mud rushed upward to a height of 600 feet or more.

Long after dark we made our way back to the shore, where with some trepidation we established our camp for the night. Before morning there occurred an explosion so violent as almost to throw us from our cots.

The following day was spent in observing the magnificent display, and in an effort to secure photographs, which was rendered comparatively fruitless by frequent rain-squalls. From time to time we were showered with mud, which burned viciously, not because it was hot, but because of the strong acid which it contained (see pages 324-6 and 350).

When I again visited the volcano, a few weeks later, the disturbance had entirely subsided, and on my next subsequent visit the newly formed crater had become converted into a lake, which ultimately dried up.

TAAL AGAIN WRATHY

Taal continued unusually quiet until January, 1911. During the night of the 27th of that month the seismographs at the Manila Observatory commenced to register frequent disturbances, which were at first of insignificant importance, but increased rapidly in frequency and intensity. The total recorded shocks on that day numbered 26. During the 28th there were recorded 217 distinct shocks, of which 135 were microseismic, while 10 were quite severe. The frequent and increasingly strong earthquakes caused much alarm at Manila, but the observatory staff was soon able to locate their epicenter in the region of Taal Volcano and to assure the public that Manila was in no danger, as Taal is distant from it some 37 miles.

Definite news that Taal was in eruption was received during the morning of January 28, in a telegram to the Director of the Bureau of Science from Mr. J. D. Ward, who conducts tourists to the volcano. Mr. Charles Martin, the government photographer, left for the scene of disturbance at 3 p. m., reaching the edge of Bombon Lake at 8 p. m. Meanwhile various other telegrams had been received at Manila, stating that a huge column of black "smoke" had been pouring out of the crater since early morning, and that sinister subterranean rumblings were causing panic among the people of the neighboring towns.

THE BRAVERY OF PHOTOGRAPHER MARTIN

As Mr. Martin was one of the few competent observers who witnessed the eruption at short range, and who was not so overcome by the awful catastrophe in which it culminated as to be unable to give any intelligent account of what occurred, particular interest attaches to his statements.

He had been sent to obtain a photographic record of the phenomena of this eruption, which no one anticipated would be destructive, and he proceeded to perform his appointed task with extraordinary coolness, and with complete disregard for his personal safety. It is due to the merest chance that he is alive today.

Early in the morning of January 29 he crossed the disturbed waters of Bombon Lake in Mr. Ward's boat and by 8 o'clock had made his way to the crater rim, from which point he secured a mag-

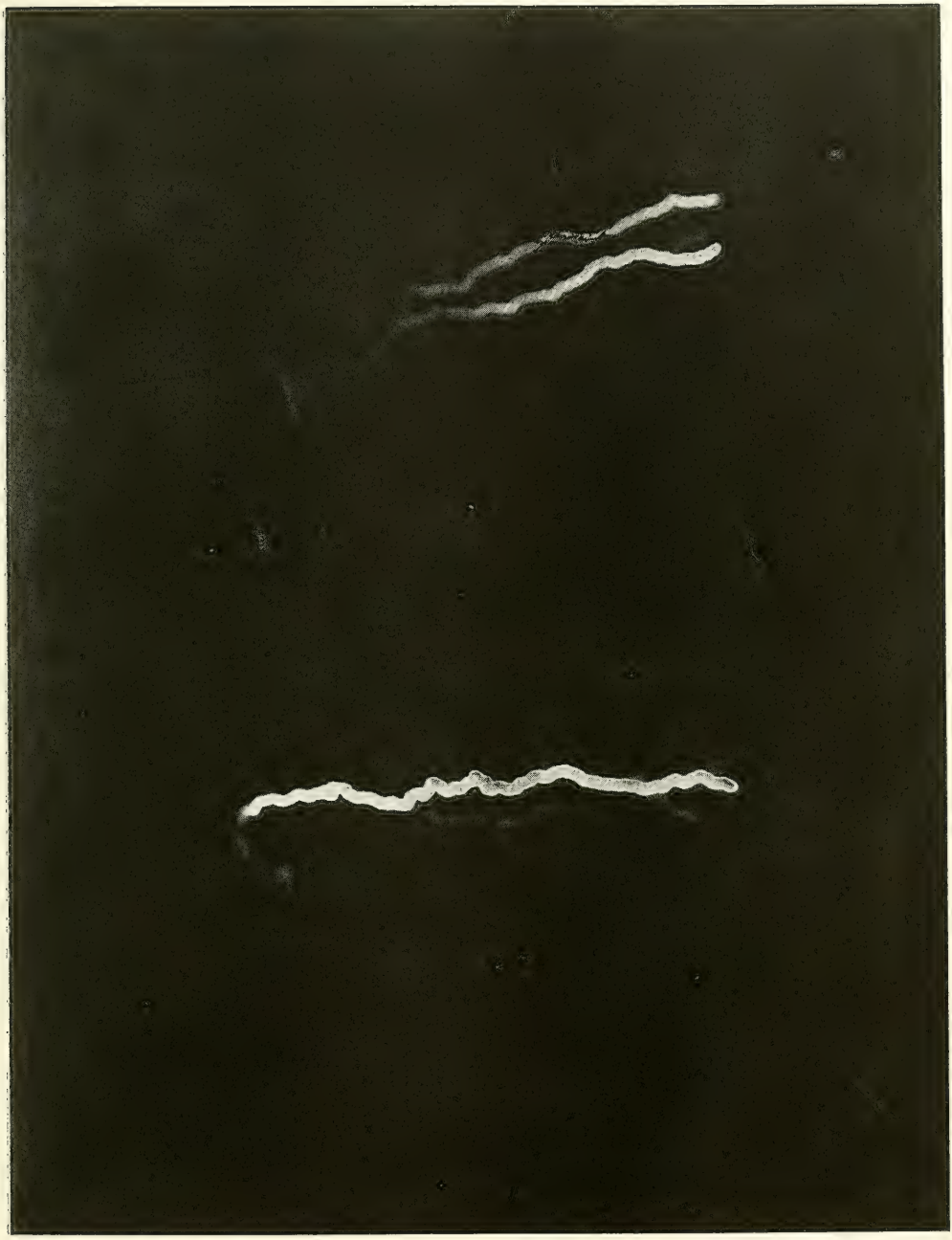


Photo by Charles Martin

LIGHTNING FLASHES IN THE CLOUD OF MUD DURING ERUPTION AT 2.30 A. M., JANUARY 30, PHOTOGRAPHED AT A DISTANCE OF ABOUT FIVE MILES

The "streams" of electricity which flowed around the lofty column of ejecta thrown out by the great explosion were of extraordinary breadth (see pages 339, 343, and 345)

Photo by Charles Martin.

A PORTION OF THE CRATER OF TAAL VOLCANO THE AFTERNOON AFTER THE GREAT ERUPTION

To the right may be seen a bit of the opening torn in the floor of the old crater by the explosion. This subsequently filled with water, which ran in from Bombon Lake through the crater walls (see page 346).

Photo by Charles Martin

TAAL VOLCANO FROM BAÑADERO THE MORNING AFTER THE GREAT ERUPTION; NOTE AT THE LEFT THE BLACK MUD BELCHING FROM THE CRATER

Photo by Charles Martin

MOUNT MACOLOD, FROM WHICH SOME OF THE PEOPLE OF BATANGAS VIEWED TAAL VOLCANO THE DAY BEFORE THE ERUPTION

Note that the shore of Volcano Island, showing in the foreground, has been swept absolutely bare of vegetation by the great explosion. (See pages 328, 329, and 356.) Mount Macolod is by some believed to be a fragment of the great volcano which formerly covered the area now

nificent series of photographs giving an impressive idea of the play of titanic forces which was then occurring (see pages 330 and 333).

It was at once evident that every weak point in the crater floor had given way. From the former site of the green lake, at one end of which was located the active crater in 1888, there rolled an enormous column of vapor, which towered skyward unil caught by the morning breeze, and was then swept, black and threatening, westward over the neighboring province of Cavite. The 1904 crater, which had long been choked with mud and stones, was again in full activity, and a small new crater had formed to the north at a point where the long-continued existence of a large solfatara had led us to anticipate that there would be a break in the event of an important eruption.

From the central and more important of these three openings enormous masses of black mud were thrown to a great height at frequent intervals, boring their way through the column of white steam. There were frequent loud explosions of sufficient intensity to shake the solid earth.

The varied phases of this imposing display tempted Mr. Martin to expose plates until his stock became practically exhausted, when he returned to Tanauan with but a single plate ready for use.

THE TERRIFIC EXPLOSION

At 1:05 on the following morning he was awakened by an extraordinarily heavy explosion and saw an enormous column of mud rising from the crater, which was distant some 11 miles. There was a magnificent display of "chain" lightning about the black mud cloud, and the explosion had awakened and terrified every one. Twelve minutes later there was a rain of mud at Tanauan. It was followed by a fall of fine, dry volcanic ejecta. Shortly before 2 o'clock the sky, which had been obscured by the black mud cloud, cleared completely.

While Mr. Martin and his companions were still discussing the imposing phenomenon which they had witnessed, there occurred at 2:20 two terrific explosions, or I should perhaps say a double explosion, for the second report succeeded the first so quickly as almost to coincide with it, and people a little further away noted but one concussion. We now know that this explosion tore most of the floor out of the main crater of Taal Volcano and hurled it skyward. A huge black cloud continued to rise for a long time. Its ejection was attended by a most extraordinary electrical display, which was visible for 250 miles.

The explosion was heard over an area more than 600 miles in diameter. In the subprovince of Kalinga the wild men thought that the dynamite stored at Lubuagan by the government for use in road construction had exploded, and throughout the following day delegations from various settlements visited the town to ask the lieutenant governor if this was the case.

Mr. Martin says that the cloud at first rose steadily, but "soon the wind got hold of it and it spread out all over the country, leaving us in total darkness. Wet mud started to come down in Tanauan about 12 minutes after the explosion and kept on falling for not less than half an hour, until it covered the ground."

A WONDERFUL ELECTRICAL DISPLAY

In Manila the shock of the explosion was so great that people leaped from their beds in terror, thinking that there had been some great catastrophe in the city. Their attention was instantly attracted by the glare of the electrical display, and many of them realized that Taal must be in full eruption. The thousands who witnessed the extraordinary sight agree that it beggared description, and few of them have even attempted to describe it. The streams of electric fluid seemed to be of extraordinary breadth.

With the instinct of the photographer still alert, Mr. Martin exposed his one remaining plate; but, unfortunately, in the excitement of the moment he failed to realize that a flash of lightning makes its own exposure; and, fearing that the steady glare resulting from the myriad discharges would fog his plate, timed his shutter to one six-hundredth of a second, with the result here reproduced.

Photo by Charles Martin

DEATH AND DESTRUCTION

Scene on Volcano Island, January 31, 1911, the day after the great eruption (see page 345)

Photo by Charles Martin

REMNANTS OF THE VILLAGE OF SUBIG, IN THE ZONE OF PARTIAL DESTRUCTION
The chief damage in this village was caused by a great wave which swept inland from Bombon Lake

Photo by Charles Martin

RUINS AT BOSOBOSO (SEE PAGE 314)

When it is remembered that these flashes were taken at a distance of some five miles through a lens with a focal length of 300 millimeters, and that the photograph is here reproduced exactly as far as regards size, some idea will be gained of the breadth of the discharges (see picture on page 335).

Father José Algué, director of the observatory at Manila, also attempted to photograph the flashes with some success, but only those who witnessed the imposing phenomenon will ever have any adequate idea of its magnitude. Some idea of the height of the column of ejecta may be gained from the fact that the electrical display about it was plainly visible 250 miles away.

Apart from the flashes, there were "globes of fire," which rose and fell in graceful curves.

Father Algué, who is a close scientific observer, has sent to the Royal Meteorological Society an account of the eruption, from which I quote the following:

"The electrical display which accompanied the eruption added greatly to the terrors of the phenomenon. As seen from Manila, at a distance of 63 kilometers from the volcano, it had the appearance of an unusually violent thunder-storm, except that there were no clouds, the brightest stars being visible through rifts in the huge black masses of smoke, ashes, and mud. During the period of greatest electric activity, which was from 2^h 30^m to 2^h 50^m a. m., I tried to secure some photographs of the phenomenon, but during a five minutes' exposure, at 2^h 40^m 45^s, only the flashes of lightning made any impression on the plate, which seems to show that the light emitted by the globes of fire was of low actinity. Some of the flashes recorded appear at an angular distance of about 13° above the horizon and 17° from the crater (toward west), which would seem to indicate that electric discharges took place up to a height of nearly 15 kilometers above the earth and at least 19 kilometers in a slanting direction (toward west) of the crater."

THE EXPERIENCES OF MR. MUNI

Mr. George J. Muni, the provincial treasurer of Batangas, who was at the provincial capital during the eruption, has given an interesting account of his observations at that place, which is distant some 14 miles from the crater. He says that the first earthquakes were felt shortly after 9 p. m. on January 27, becoming much more severe at 11 p. m., and that by midnight sleep was impossible. By 3 a. m. many of the residents had deemed it advisable to leave their houses and camp in open places. During the 28th the earthquakes were so frequent and severe that all government buildings and large houses of heavy materials were vacated. The ground trembled constantly and steam rose from the volcano in a steady cloud. He continues:

"On Sunday morning, January 29, we were beginning to feel the effects of this trying and unusual experience and the loss of sleep; so, to divert our minds and to obtain a good view of the volcano, a number of us went by *carromata* to the town of Cuenca and climbed the west shoulder of Mount Macolod. From this elevation, which was considerably above the volcano, we could see into the crater, as it is located at the end of the island in Lake Taal, nearest Mount Macolod.

"We spent about three hours on the mountain observing the volcano, and noticed that after each earthquake a volume of steam would belch forth from the crater. During severe shocks we could see the mountain on which we were move and rock. The volcano on the whole seemed to be much quieter than the previous day, and upon our return to Batangas in the late afternoon we decided to try sleeping indoors again.

"We retired early, worn out from the two previous nights' loss of sleep and our trip, and slept soundly for an hour or two. We were then awakened, however, by a severe shock and could not again sleep, as the quakes became more frequent and heavy, so that shortly after midnight my wife and I decided to again vacate the house, and had cots taken out to the grounds of the government building. We did not sleep, but lay with our faces towards the volcano.

"Suddenly, shortly after 1:00 a. m., we saw flashes of light, felt a severe shock, and heard a loud rumble. Then a thick, black, balloon-shaped cloud arose

Photo by Charles Martin

GRAVE IN WHICH WERE BURIED 131 VICTIMS OF THE ERUPTION: NOTE HOW THE TREES HAVE BEEN DEVASTATED AND EVERY TRACE

Photo by Charles Martin

PORTION OF A TREE TRUNK WITH BARK CUT TO PIECES BY THE BLAST FROM THE VOLCANO

Note that the bark is not burned

from the crater and hung over it, and was illuminated by sharp flashes and streaks of lightning. This lasted about five minutes, when the wind dispersed the cloud and the flashes of lightning ceased.

"The earthquakes from then on seemed to be more violent until, at about 2:20 a. m., a great explosion occurred, and we saw balls of fire shoot up above the crater and an immense column of smoke and ashes arose and formed a great cloud, which appeared to be several miles in height. This was lighted up by a very vivid electrical display and accompanied by long, heavy rumblings, all of which lasted about 15 or 20 minutes. Then the wind blew the cloud of smoke and ashes in a northeasterly direction, towards Tanauan, and the smoke continued to pour forth from the crater for many hours. No further eruption was witnessed.

"The severity of this explosion drove most everybody out of their houses and created great excitement, and most of the people walked the streets or stayed in the plaza until morning, wondering what would happen next."

THE AWFUL SLAUGHTER OF FILIPINOS

The thousands upon thousands of people who were awakened by the final explosion in time to see the enormous column of ejecta shooting up from Taal, and to witness the extraordinary attendant electrical display, little dreamed that in the twinkling of an eye some 1,400 human beings had perished. Indeed, a period of several days elapsed before it was realized at Manila that an appalling calamity had occurred. This was largely due to the fact that there was a sharply marked zone of devastation, within which the destruction of life and property was practically complete, while outside of this region comparatively little harm was done. It is a gruesomely significant fact that the known killed numbered 1,335, while the known wounded, many of whom were terribly injured, and not a few of whom subsequently died, numbered only 199.

The fall of mud was deep enough over the area of complete destruction to render travel excessively difficult, and the

SCIENTISTS UNDER FIRE

Government Photographer Charles Martin and Geologist Wallace E. Pratt, both of the Philippine Bureau of Science, on the edge of the crater of Taal Volcano on the day of the great eruption. Mr. Martin at this time secured many of the photographs illustrating the present article. Fifteen minutes after these young men left Volcano Island there occurred a tremendous explosion, sending forth a cloud of mud and fumes which rolled

vegetation, broken and tangled by the fierce blast from the volcano, still further impeded progress. Communication by water along the lake shore continued for some time to be hazardous in the extreme. The only launch on the lake was driven inland by a huge wage and badly injured. Many of the small native boats were destroyed.

The cloud of ejecta was seen to drift towards Tanauan and Santo Tomás, and it was believed that these places would suffer most severely. They were immediately communicated with and reported a heavy fall of "ashes," which had seriously damaged crops but had caused no casualties among the people. Taal and Lemery also reported that no important damage had been done.

The stranded launch was put into commission, although still in a partially disabled state, the afternoon after the eruption, and in it Mr. Martin and others proceeded to Volcano Island, where they found, as had been anticipated, that the devastation had been complete.

THE HEROISM OF SCHOOLMASTER BUCK

Meanwhile Mr. H. H. Buck, the division superintendent of schools of Batangas, made his way to the west shore of the lake, fearing for the safety of the people there. As promptly as possible, after discovering the terrible truth, he pushed through to a point from which communication could be had with Manila and sent a laconic telegram, reading as follows:

"Have visited barrios on west-side lake. Five totally destroyed. Loss of life not less than three hundred. Many burned. Houses destroyed. Need funds. Calamity."

This telegram, received at Manila at 7.55 p. m. on the day of the eruption, embodied the first intimation that there had been loss of life and served to set the wheels moving.

Let no one think that it was a pleasure trip that this young man took across Bombon Lake. The volcano was still terrifyingly active and no one knew when there might be another death-dealing explosion. No less than 88 earthquakes, having their origin in the volcano, were recorded during that day at Manila. Ten of them were quite severe, and all were, of course, far more strongly felt on Volcano Island and on the shores of Bombon Lake than at a point 39 miles distant.

The waters of the lake were constantly disturbed by the movements of the earth, and were liable at any moment to rise in overwhelming waves like those which had swept away whole villages in the early morning.

But this school teacher coolly set sail in a frail native craft and proceeded to visit the area which the volcano, still in eruption, had just devastated, and when he left took away with him not only reliable information as to the conditions there, but eleven badly wounded survivors and the bodies of many of the dead.

How often it is true that a great emergency calls forth from the common crowd a man ready and able to meet it. The *only* man who realized and met the emergency in this sorely stricken region on that dreadful day was H. H. Buck.

The American treasurer of Batangas, Mr. Muni, was in Manila when Mr. Buck's telegram was received. He hurried back to his province overland and inaugurated effective relief measures immediately upon his arrival, working unremittingly until the crisis had passed.

As speedily as possible launches were dispatched from Manila with a detachment of the U. S. Army Burial Corps under command of Captain Metcalf. There were also sent a physician, a motor boat for use on the lake, and medical and commissary supplies. Colonel Kingsbury, in command at Camp McGrath, promptly ordered Dr. Kennedy to Taal and later had many of the wounded cared for at the post hospital. Other doctors were rushed to the scene at once. There were immediately established a dressing station at San Nicolas, on Bombon Lake, and a receiving station at Taal. From Taal the wounded were sent to the Army hospital at Camp McGrath or to the Philippine general hospital at Manila.

Captain Metcalf and his men pushed

Photo by Charles Martin

MUD BLAST FROM THE CRATER OF TAAL VOLCANO

This photograph was taken by Charles Martin the afternoon following the great eruption
(see pages 346 and 355)

Photo by Charles Martin

THE BEGINNING OF THE EXPLOSION ON THE AFTERNOON OF THE DAY OF THE GREAT ERUPTION

through to the lake shore with all possible speed. They could not obtain boatmen or even paddles, but taking possession of a leaky old dugout, and using their shovels for paddles, they embarked on the troubled waters of the lake, reached the devastated area, and began their gruesome but necessary task.

The force of Philippines constabulary, which was camped near the lake at the time of the eruption, was promptly added to and rendered effective service in maintaining order and assisting the panic-stricken people. Promptly upon request, officers and men of the U. S. Army Signal Corps opened up communication with the devastated area by means of field wireless apparatus and of quickly constructed telephone and telegraph lines.

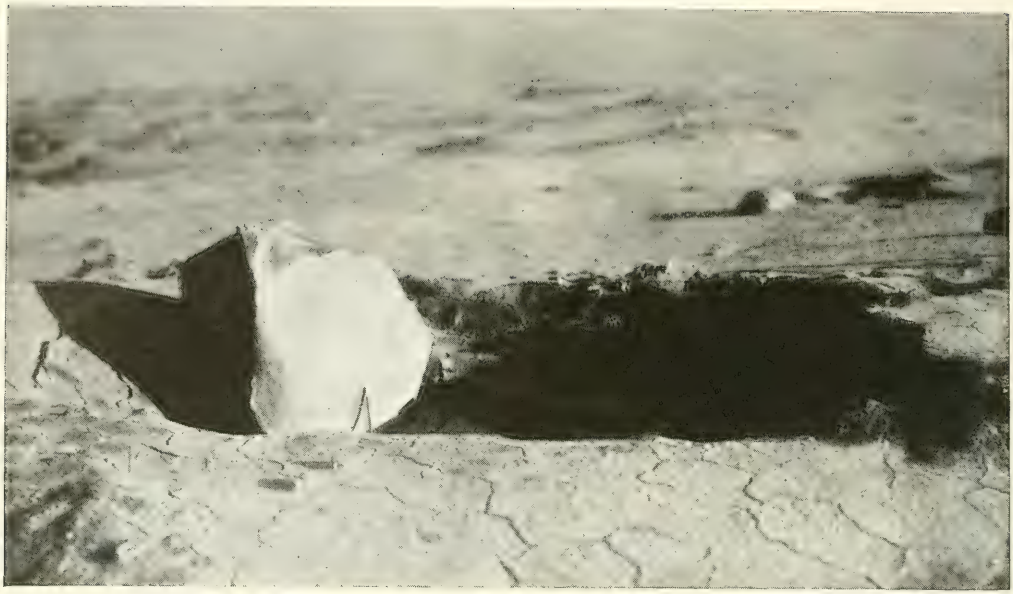


Photo by Charles Martin

A BOMB

Note the pit in the mud made by this rock when it fell. Few rocks of any great size were ejected from the crater during the eruption

THE FLESH WAS BURNED BY ACIDS

The dead and the wounded were found in most unexpected places. Not a few persons had been fleeing in terror as a result of the explosion which had occurred at 1:05 when overwhelmed by the final cataclysm at 2:20, and had meanwhile been able to travel a considerable distance from their homes. Many were washed inland by the waves from the lake and were buried under piles of débris.

Most of the survivors were horribly injured. In numerous instances their flesh was lacerated and their bones were fractured by stones from the volcano, falling timbers of houses, or flying débris driven by the dreadful blast from the crater, while most of them had horrible injuries the exact nature of which is in dispute. They have been almost invariably referred to as "burns," but the fact that clothing was not charred in any observed instance negatives the idea that the dead were killed, or the wounded injured, by fire.

It was noted, furthermore, that the bark of the stumps of trees on the side towards the volcano was often cut to tow, when not completely destroyed, and that the resulting fine strands of wood fiber were not burned, and in my opinion there is little doubt that a large majority of the killed and wounded were injured by what was in effect a gigantic sand blast. This view is strengthened by the fact that in many cases the thinnest and most transparent fabrics sufficed completely to protect the underlying flesh.

It has been stated that a large number of the victims were terribly scalded by hot mud. I doubt whether the mud was really *hot* enough to scald when it struck persons living at any considerable distance from the volcano, and believe that many of these burns were *chemical,* and were due to the fact that the mud was heavily charged with strong acid (see also page 334).

Chemical examination had long before demonstrated the fact that the waters of one of the crater lakes contained sulphuric acid in sufficient quantity promptly to attack the skin of one's hands. It was furthermore noted during this eruption that the thinnest coating of mud sufficed to kill green leaves and grass. The volcanic ejecta are still so strongly acid that it has proved impossible to raise crops where they have

Photo by Charles Martin

THE EXPLOSION ON THE AFTERNOON OF THE DAY OF THE GREAT ERUPTION

A heavy cloud of fumes settled down over the island, completely enveloping it. This photograph shows the gases actually settling. The government photographer had just left the island. A few minutes' delay would probably have cost him his life (see page 346).

Photo by Charles Martin

PART OF THE SHORE OF VOLCANO ISLAND SUBMERGED DURING THE ERUPTION

Photo by Charles Martin

STUMPS OF TREES ON VOLCANO ISLAND

The trees were torn off by the blast from the crater. Note that the bark is cut to pieces but not burned (see page 355)

fallen in any considerable quantity. Suffocation was undoubtedly also an important cause of death.

There is strong evidence that there were a number of extremely local explosions, confined to single houses or to individual rooms in houses, which were apparently caused by the ignition of explosive gases from the volcano. The victims of such explosions may well have been burned by fire.

Red Cross funds and other relief funds were speedily made available, and food and shelter were immediately provided for the destitute and the homeless. Work was provided for the able-bodied by the inauguration of road construction in the vicinity.

A distressing feature of this calamity was that crops and grasses were killed over immense areas within which no other very serious damage was done, with the result that a large number of domestic animals starved to death.

There was at the outset a woeful lack of appreciation of the magnitude of the calamity, due in part to the causes already mentioned, and in part to the fact that such really authentic statements as were at first made relative to the havoc wrought were rather heavily discounted, both by the Manila public and by government officials, accustomed as they all were to greatly exaggerated first reports of the damage caused in the Philippine Islands by typhoons, conflagrations, and earthquakes.

Undoubtedly a limited number of wounded persons, whose lives might have been saved by quicker action, perished miserably; but on the whole the relief work was efficient, in view of the great obstacle encountered in the lack of water transportation, a lack which should never

Photos by Charles Martin

SOME OF THE DEAD IN THE VILLAGE OF BIGNAY: SMOTHERED AS THEY SLEPT AND BURIED IN THE RUINS OF THEIR FALLEN HOUSES

SCENE ON THE MAINLAND WEST OF THE VOLCANO, SHOWING THE EFFECT OF THE BLAST FROM THE CRATER

again be allowed to exist on Bombon Lake.

The official figures as to the number of dead and wounded have already been given, but as whole villages were wiped out of existence, and as the survivors in other villages were scattered, it necessarily follows that the exact number of persons who perished will never be known.

PHOTOGRAPHER MARTIN STILL UNDAUNTED

Mr. Martin and his companions set out from Bañadero for Volcano Island in a partially crippled launch at 1 p. m. on the day of the eruption. Mr. Martin reached the crater rim at 3 p. m. and completed his remarkable series of photographs, although the activity within the crater was still terrifyingly intense and the earth was constantly shaking under his feet. At 3:45 the party left.

Fifteen minutes later there occurred a tremendous explosion (see pages 335, 346, and 348), which again deluged the island with mud, while a black cloud of noxious fumes rolled down the slopes of the volcano to, and over, the neighboring waters of the lake.

Of this adventurous journey Mr. Martin says:

"At the time, it was my own opinion that absolutely no animal life could have withstood and lived through the eruption on the island; it was completely devastated, not a blade of grass escaping. Large trees 8 inches in diameter were broken, leaving stumps of 1 foot or 1½ feet high. The ends of these stumps were shredded like whisk-brooms by the fall of sand and small stones driven by the force of the eruption. A large stone weighing not less than 600 pounds was projected clear on top of the highest ridge.

"A rock was found with its surface fused, giving it the appearance known as 'bread-crust'; the greatest diameter of this stone was one meter. But I did not see any fire or red-hot stones thrown up. The heat was possibly enough to fuse rock, but of course from Tanauan I could not see such things erupting, and while I was on the crater's rim there was nothing thrown up that could possibly be called 'fiery.' The eruption consisted mainly of mud, and very wet mud at that.

"The trees on the island were broken and were found lying in a direction radiating from the crater. The fall of the mud, though sufficient to break up all branches, was not sufficient to break the trunks, which were nevertheless torn off at 1 to 1½ feet from the ground. Such results were caused by the terrific explosions.

"The whole island had also subsided about 8 to 10 feet. This is readily attested by the trees, which used to be on high ground and are now found several feet in the water. Such trees do not live in the water."

Mr. Martin subsequently accompanied relief parties and also went with the men sent out by the Bureau of Science to investigate the results of the seismic activities which had accompanied the eruption, so that his series of photographs very fully covers both the eruption and its material effects in the surrounding country.

THE DEVASTATING BLAST FROM THE CRATER

There has been much discussion as to the cause of the devastating blast from the crater, and as to the reason why its effect was so much more serious on the west coast of the lake than elsewhere.

There is no doubt that an immense body of steam and gases, heavily charged with fine volcanic ejecta, swept downward and outward in all directions from the crater rim. It stripped Volcano Island bare of all vegetation; caused a huge wave to extend outward over the surface of the lake; blew houses to bits; broke off many great forest trees; bent saplings, bushes, bamboo, and tall grasses to the ground on the mainland; and dealt instant death to every living creature fully exposed to its fury. The human beings who escaped owe their lives to the fact that they were blown into the lake, or were in especially protected spots.

EXPERIENCES OF PRIVATE COUCH

The few survivors within the zone of devastation were so overwhelmed by the

Photo by Charles Martin

SITE OF THE VILLAGE OF PIRAPIRASO, ON VOLCANO ISLAND, IN THE ZONE OF COMPLETE DESTRUCTION

Not a living thing escaped in this village. It was devastated by a blast from the volcano, and its ruins were then swept into the lake by the receding of a wave which was caused by the blast or by seismic action

Photo by Charles Martin

THE EARTHQUAKES WHICH OCCURRED DURING THE ERUPTION CRACKED THE GROUND AS FAR AWAY AS LEMERY, WHERE THIS PHOTOGRAPH WAS TAKEN

dreadful experience through which they had passed that for the time being they nearly or quite lost their reason, and later could give no intelligible account of what occurred. Special interest, therefore, attaches to the statement of private William C. Couch, Company "E," 2d Battalion, Engineers, U. S. A., who was at Bayuyuñgan, where the destruction was only partial and where but 98 persons out of 800 were killed. He says:

"With a mapping and surveying party I was camped at Bayuyuñgan, Batangas, on January 28, 1911, when the Taal volcano went into a state of eruption. The camp was located about four miles northwest of the crater and about a quarter of a mile from the shore of Lake Taal. About 3 a. m., January 28, the volcano showed signs of eruption. There were severe reports caused by the explosion of gases above the crater and an electrical display lighted up the heavens. Large volumes of smoke were pouring out of the crater and were carried off to the southward by the wind. This condition lasted about three minutes. Earthquakes of more or less severity were felt throughout the dawn of January 28. Smoke issued from the crater and ashes fell in our camp nearly all the day.

"On January 29 heavy volumes of smoke poured out of the crater, accompanied by slight earthquakes, until about 4 p. m., when a severe quake was felt. I was asleep under a tree and was nearly thrown from my bunk by the violence that ensued. The shocks then lessened in frequency and severity until about 11 p. m., when another heavy shock was felt. After this we went to sleep.

"About 1 a. m., January 30, I was awakened by a loud rumbling noise. I got up and stepped outside of the tent. Looking across the lake in the vicinity of the volcano I saw great volumes of black smoke pouring out of the crater, accompanied by heavy explosions, resembling heavy artillery in action, and electrical display. The smoke drifted over our camp and there was a light fall of ashes. The explosions ceased, and thinking that the disturbance was at an end we again retired and most of the men had gone to sleep when the loud rumbling noise was again heard, and before I could get out of bed an explosion of indescribable severity took place.

"On getting out of the tent I saw the smoke was coming out of the crater in dense clouds. Thinking that there was going to be an eruption, I awakened the sleeping men and wanted to vacate the camp, but we finally concluded to remain.

"The rumbling noise grew louder and louder and then a heavy report. I then saw the mud issuing from the crater as a cloud. In a few seconds I saw this cloud drifting across the lake toward our camp. Our camp was then swept by a heavy wind which broke the tent ropes and threw the tent into the air. This atmospheric disturbance threw me a distance of about 15 feet.

"Then there was a rain of ashes which fell to the depth of about 8 inches. The air was oppressive and we had to gasp for breath; this lasted about 20 seconds. Then there was a light warm shower of rain, followed by another fall of ashes, which lasted about half a minute. After this there was a cold heavy fall of rain that continued for about 15 minutes.

"By this time a tidal wave from the lake had reached our camp (a distance of about a quarter of a mile) and we took to a small hill about 50 yards away to the north of the camp. The bamboo and underbrush on this hill was so twisted that we could not penetrate it, but we had reached a safe elevation and we rested and waited for day to break. While waiting at this place a scout soldier came to us. Seeing a native coming across a field with a torch, the scout hailed him and he came to us and took us to a native house near by, where we remained until daylight.

"After daylight we returned to the site of our camp to recover what articles we could, but we found that everything had been washed away. We then started for Lemery, about 28 miles away, reaching that place about 5 p. m., January 30,

Photo by Charles Martin

CAYSASAY CHURCH, IN THE TOWN OF TAAL, SHOWING DAMAGE CAUSED BY EARTHQUAKES DURING THE RECENT ERUPTION

(See page 320 for the story of this church in the eruptions of 1754)

hungry, thirsty, and worn out by our experience. One of the party was slightly burned about the arms with hot ashes, but otherwise we did not suffer any bodily injuries."

The fact that the zone of greatest destruction was to the west may be partly due to the lowness of the crater wall on this side.

It has been claimed that the gentle wind which was blowing at the time greatly influenced the direction taken by the devastating blast, but in view of the fierceness of the blast I confess myself unable to accept the theory that its direction was greatly influenced by a mere breeze.

Father Algué has suggested that the air above the crater was heavily charged with the matter thrown upward by the very severe explosion which had occurred a short time before, and that the inertia of this mass was sufficient to turn outward and downward the uprushing column of ejecta. Whatever may be the physical explanation, there is no doubt as to the fact.

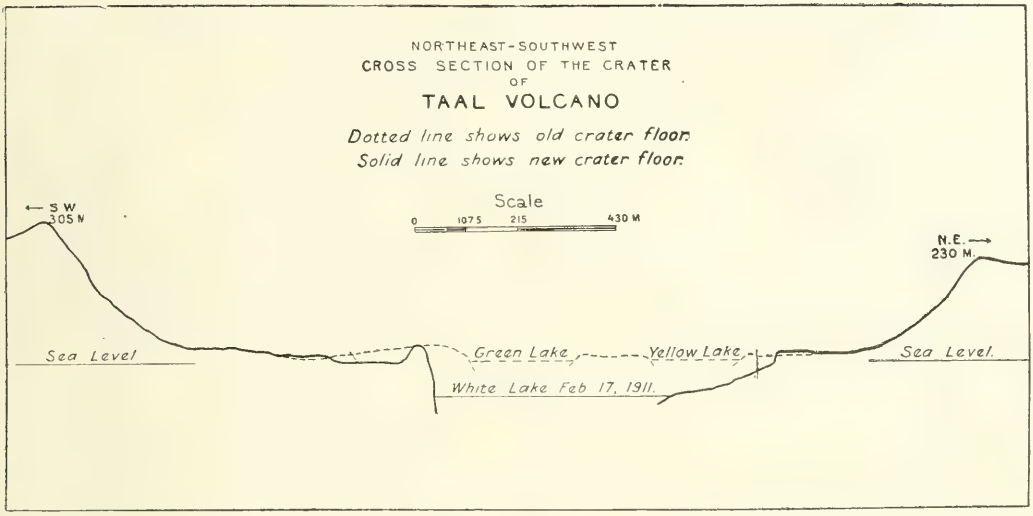
The eruption spread mud and volcanic ash in readily perceptible quantity over an area some 1,200 square miles in extent. Dust fell over a very much more extensive area, especially to the northward. Much of the ejected mud was quite fluid and ran into ravines and other low places, thus creating misapprehension in the minds of careless observers as to the depth of the deposit.

On the western slopes of the volcano, where the fall was heaviest, it reached a depth of 6 feet or more in ravines, while ridges were often left nearly bare. Mr. Pratt considers the average depth here

Photo by Charles Martin

THE DEAD AND THE LIVING

Among the few creatures which escaped death on Volcano Island during the great eruption were two puppies, which may be seen in the hands of the constabulary officer



CROSS-SECTIONS OF TAAL VOLCANO BEFORE AND AFTER THE GREAT ERUPTION

to have been 8 to 12 inches. On the neighboring mainland it was slightly less.

Newspaper reports, to the contrary notwithstanding, there was no flow of lava during this eruption, nor is there evidence that there has ever yet been a lava flow from this volcano.

While a number of observers report having seen a bright glow in the cloud overhanging the crater, and while Father Saderra Masó has suggested that this may have been due to the reflection of light from a mass of exposed lava, which was soon afterward blown to fragments by escaping steam, the fact remains that no particles of fresh lava can be detected in the mud or ash thrown out, and this theory must therefore be abandoned. The glow observed was doubtless caused by incandescent gases or by electrical discharges.

It is certain that incandescent rocks were ejected, although in comparatively small number. Most of the rocks thrown out, whether glowing or not, were of small size.

Attention has already been called to the fact that the ejected mud was strongly acid. It burned every living thing on which it fell and, driven by the force of the great explosion, tore the bark from trees and the skin from human beings.

THE AREA OF DEVASTATION

The area materially affected by the seismic disturbances caused by this eruption was some 200 miles in diameter. The number of such disturbances which occurred before, during, and soon after the eruption was extraordinary. From January 27 to February 7, inclusive, there were recorded at Manila 472 disturbances of intensity I, 97 of intensity II, 76 of intensity III, and 62 of intensity IV, with sufficient additional micro-seismic disturbances to bring the total up to the unprecedented number 995.

The more violent earthquakes greatly alarmed people as far north as Manila, but actual damage was practically limited to the land area inclosed between the two fissure lines shown on the map on page 315. Along these lines there were vertical displacements of 1 to 2 or more yards. The highway along the sea near Lemery sunk so that it was under water at high tide.

At Sinisian, where the westernmost of the fissure lines intersects the coast line, there formed on the sea beach a little crater, from which mud was at times ejected to a height of 100 feet. Puffs of gas were in a number of instances discharged with considerable violence when the fissures opened. A great part of the region between the two fissure lines settled materially. Volcano Island

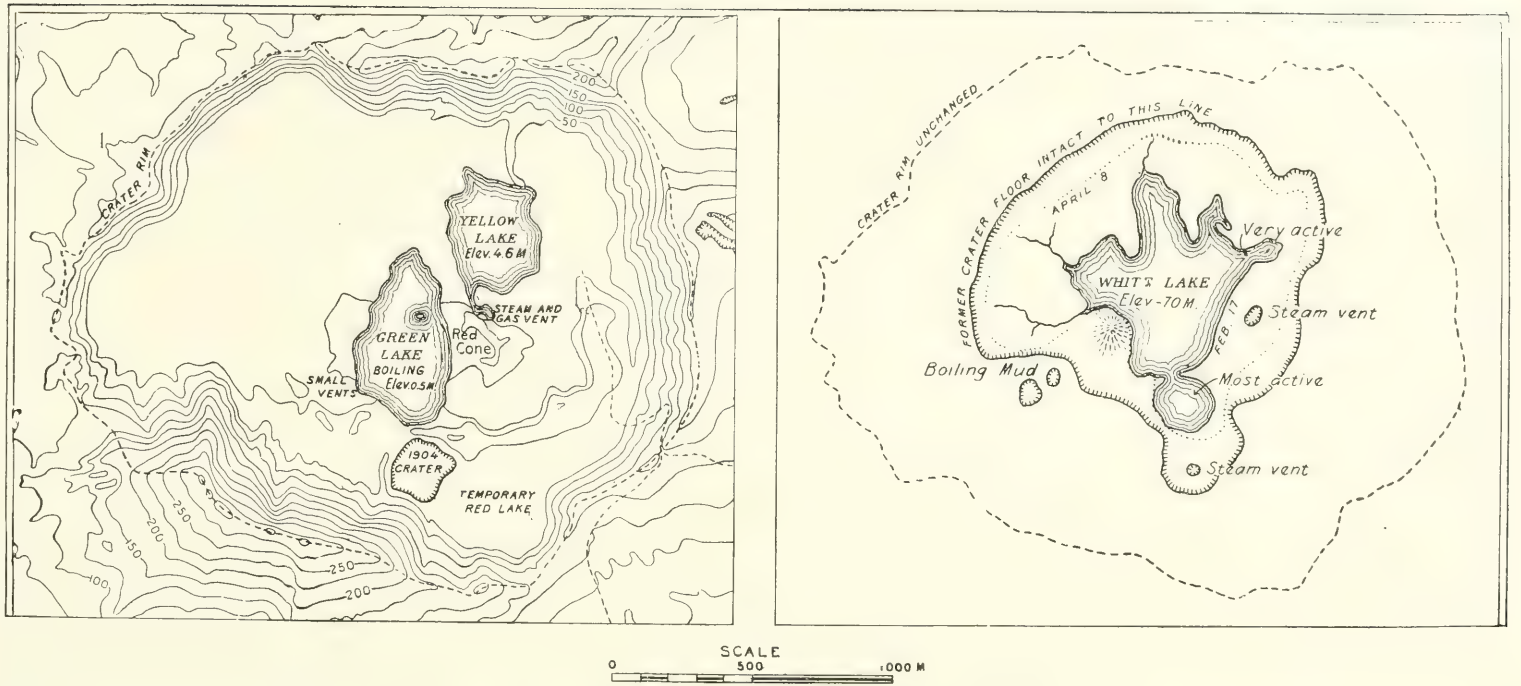
Photo by Charles Martin

PORTION OF TAAL VOLCANO THE AFTERNOON BEFORE THE GREAT ERUPTION

Photo by Charles Martin

A PORTION OF THE CRATER OF TAAL VOLCANO THE AFTERNOON AFTER THE GREAT ERUPTION

This photograph was taken from the same position as the preceding one. The three craters shown there have now become a part of one great crater, from which protrudes an obelisk barely visible through the clouds of steam. Note how the earth in the foreground is pitted by falling stones



OUTLINE MAPS SHOWING THE CRATER OF TAAL VOLCANO IMMEDIATELY BEFORE AND SHORTLY AFTER THE GREAT ERUPTION

The map at the left shows the crater as it was just before the great eruption. The blue lake, observed by Secretary Worcester in 1888, had completely disappeared. The 1904 crater had formed and at its base lay a temporary red lake formed during the rainy season. Otherwise the crater had remained practically unchanged since 1888. The map at the right shows the effect of the great eruption which blew out the former crater floor within the area inclosed by the hatched line. On February 17, 1911, a rapidly forming new white lake had reached the dimensions shown in the map to the right, and on April 8 it had extended so as to cover the area inclosed by the dotted line. (From the Philippine Journal of Science, Vol. VI, No. 2.)

PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO BEFORE THE GREAT ERUPTION, LOOKING WEST

Binintiang Malaqui marked with a cross. Crater of 1904 partially filled with mud at the left. Active crater in the center. Steam issuing at the right where a small crater formed in January, 1911

PANORAMIC VIEW OF THE CRATER OF TAAL VOLCANO AFTER THE GREAT ERUPTION, LOOKING WEST Photos by Charles Martin

Binintiang Malaqui marked with a cross. The lake is some 1,200 yards long, and was formed after the great eruption by water pouring in from Bombon Lake through the cracks in the crater wall

settled from 3 to 6 feet and parts of it much more than this.

Some persons believe that the wave extending outward from the volcano, which swept the lake shore and caused such serious loss of life and damage to property, was caused by the sudden subsidence of the island, but such an occurrence would probably have been attended by a severe earthquake, and there was no earthquake at this time. Indeed there is very definite direct evidence that the settling was gradual. When Mr. Martin first visited the island after the eruption, the floor of Mr. Ward's house was just awash. When he returned later the house was completely submerged.

COMPARISONS WITH MONT PELÉE

It is interesting to compare the results of this eruption with those of the eruption of Mont Pelée, which occurred in May, 1902. The area devastated by Pelée was approximately 52 square miles; that devastated by Taal was approximately 142 square miles. Pelée killed some 30,000 people, while Taal killed only about 1,400, but this comparatively small number of casualties was due solely to the fact that the territory devastated was very sparsely inhabited. The village of Gulad was the same distance from the crater of Taal as was St. Pierre from the crater of Pelée. In Gulad 116 out of 120 inhabitants were killed outright and the four survivors were dreadfully injured. Had there been a large city at this distance from Taal the mortality would have been horrible.

The force of the eruption from Pelée would seem to have been greater than that from Taal, as Pelée spread ashes in one direction for a distance of 100 miles, whereas the greatest distance to which Taal sent any considerable fall of ashes was 32 miles.*

Why, then, was the zone of complete destruction around Taal so much larger than that around Pelée? The probable explanation is a simple one. In each instance the expanding mass of gases from the crater tended to extend itself in all directions. The crater of Pelée was some 4,002 feet above the sea, while the crater rim of Taal was in places less than 400 feet above the lake.†

Mr. Pratt has called attention to the fact that this eruption of Taal may be accurately described in the following words applied by Hovey to the eruptions of La Soufrière and Mont Pelée in 1902:

"It is evident that there was a blast or a series of blasts of hurricane violence from the crater . . . as a feature of the eruptions. . . . The overturned trees constitute the principal evidence. . . . They all point away from the crater except for slight modifications due to local topography. The blast extended radially in all directions from the crater, suggesting the explanation that some great volume of steam, rising from the throat of the volcano, could not find room for expansion upward on account of the column of steam and ashes which had preceded it and the ashes falling therefrom, and that it expanded with explosive violence horizontally and downward, following the configuration of the mountain."

TODAY TAAL VOLCANO SLUMBERS PEACEFULLY

Today Taal Volcano slumbers peacefully. The great gap recently torn in its crater floor is filled by the shimmering waters of a placid lake, from which there hardly rises so much as a whiff of steam; but somewhere below that smiling surface titanic energies are again slowly but surely gathering. Sooner or later they will once more rend the solid earth asunder in an explosion which will blow rocks and earth to powder and drive that powder in a death-dealing blast across the neighboring country. What precautions should be taken to prevent future great loss of life?

The reason why the last eruption of Taal killed more people than have any of its known predecessors is that the territory in the vicinity of the volcano had become more thickly settled. The rich soil of this region tempts the Fili-

*See NATIONAL GEOGRAPHIC MAGAZINE, 1902.

†Philippine Journal of Science, Vol. VI, No. 2, p. 83.

pino farmers, who will rebuild many of the obliterated villages if allowed to do so. The inevitable result will be that sooner or later they or their descendants will be hurled into eternity, when the volcano again rouses from its sleep.

How are such conditions to be met? Shall residence within the danger zone be prohibited? And what *is* the danger zone? No one can say with certainty. Stretching across Cavite province to and beyond Manila are thick deposits of volcanic tuff believed to be composed of ejecta from the crater of a great volcano which once stood where Bombon Lake now lies. A new crater may form at any time along either of the fissure lines hereinbefore mentioned.

After the recent eruption the waters of Bombon Lake flowed slowly into Taal through fissures in its walls, forming the present crater lake. Should a seismic shock crack the earth's surface at this weak point and allow these waters to reach the fires underneath, what would be the result? It is certainly well within the limits of possibility that the map of Batangas Province might be suddenly and materially altered, and that the people of New England might again be favored with some of those wonderful red sunsets which followed the blowing up of Krakatoa.

One cannot travel fast or far in a country buried in mud, but the waters of Bombon Lake can be navigated except when they are being swept by typhoons or by giant waves due to profound seismic disturbances. It is certain that relief can best reach most points on the lake shore by water, and in my opinion the Philippine insular government should therefore maintain there, and keep ready for instant use in case of emergency, suitable and adequate equipment for water transportation. The establishment on Volcano Island of a small and very strongly constructed observatory, properly equipped with a universal seismograph and with apparatus for studying subterranean sounds, would be a wise precaution. There should also be established on the neighboring mainland a larger and more complete station, where an observer would reside and be on duty except when visiting the station on the island, which he should do daily. The seismic disturbances which precede an eruption would then be noted and timely warning given.

It would be a wise precaution to allow no one except scientific observers to reside within the known danger zone. So far as concerns Volcano Island, the prohibition should be sweeping and absolute.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

ORNAMENTAL SCARRINGS WHICH ARE POPULAR IN GERMAN EAST AFRICA

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg
Cassell & Co. (New York)

A WATUSSI OF GERMAN EAST AFRICA

A LAND OF GIANTS AND PYGMIES

By the Duke Adolphus Frederick of Mecklenburg

No section of Africa is so crowded with variety of interest as the large province of German East Africa. Its neighbor on the north, British East Africa, has been traversed by many big-game hunters and colonists, and described in scores of books, but the German possession is comparatively unknown. The Duke Adolphus Frederick of Mecklenburg has recently published a large volume describing two years' explorations in the German province. His book is packed with graphic and powerful descriptions of the strange peoples and remarkable group of active volcanoes in the territory. Through the courtesy of the American publishers, Cassell & Company, we are able to publish the following chapter from the book.

RUANDA is certainly the most interesting country in the German East African Protectorate—in fact, in all Central Africa—chiefly on account of its ethnographical and geographical position. Its interest is further increased by the fact that it is one of the last negro kingdoms governed autocratically by a sovereign sultan, for German supremacy is only recognized to a very limited extent (see map, p. 388).

Added to this, it is a land flowing with milk and honey, where the breeding of cattle and bee-culture flourish and the cultivated soil bears rich crops of fruit. A hilly country, thickly populated, full of beautiful scenery, and possessing a climate incomparably fresh and healthy; a land of great fertility, with watercourses which might be termed perennial streams; a land which offers the brightest of prospects to the white settler.

Ruanda is doubtless, with the exception of Urandi, the last sultanate or "kingdom" in Central Africa which is governed today, as in centuries gone by, by a prince clothed with absolute and illimitable powers. There is only one ruler, and no rival sultans are allowed.

To any one with an intimate knowledge of African affairs it seemed a sheer impossibility that so powerful a sovereign, the ruler over some one and a half million people, would voluntarily submit to the new régime and agree to enter upon no undertakings within his vast, thickly populated, and unexplored realms except by permission of the European Resident.

To compel him to do so would have meant bloody wars and an enormous sacrifice of human life as the inevitable consequence. The sudden change of existing conditions, too, would have involved a heavy pecuniary sacrifice, as the government would have found it necessary, with such a large population, to appoint a relatively large number of European officials. As such measures would have proved impracticable, complete anarchy would have followed.

So the country was therefore allowed to retain its traditional organization, and the Sultan was given full jurisdiction over his fellow-people, under control of the Resident, who was to suppress cruelty as far as possible. In one word, the government does not acknowledge the Sultan as a sovereign lord, but fully recognizes his authority as chief of his clan. Kindred tribes, non-resident in Ruanda, are therefore not subject to the Sultan's jurisdiction, but are under the administration of the Resident.

The fundamental principle is the same with all Residents. It is desired to strengthen and enrich the Sultan and persons in authority, and to increase thereby their interest in the continuance of German rule, so that the desire for revolt shall die away, as the consequence of a rebellion would be a dwindling of their revenues. At the same time, by steadily controlling and directing the Sultan and using his powers, civilizing influences would be introduced. Thus by degrees, and almost imperceptibly to the people and to the Sultan himself, he

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE CARAVAN ON THE MARCH IN RUANDA

eventually becomes nothing less than the executive instrument of the Resident (see pages 373 and 374).

The people hold their "Mami," which is the official title of the Sultan, in the greatest awe and reverence. It is extremely rare for any one to venture to thwart his will, for the Sultan is the owner of the land and all the stock, oxen, calves, goats, pigs, etc. The people certainly enjoy the use of them, but the Sultan retains the power of demanding at his pleasure the return of his property from his subjects.

The population is divided into three classes—the Watussi, the Wahutu, and a pygmy tribe, the Batwa, who dwell chiefly in the bamboo forests of Bugoie, the swamps of Lake Bolero, and on the island of Kwidschwi on Lake Kiwu.

The primitive inhabitants are the Wahutu, an agricultural Bantu tribe, who, one might say, look after the digging and tilling and agricultural economy of the country in general. They are a medium-sized type of people, whose ungainly figures betoken hard toil, and who patiently bow themselves in abject bondage to the later arrived yet ruling race, the Watussi.

THE LONG-LIMBED WATUSSI

The immigration of the Watussi is, without doubt, connected with the great tribal movement which brought the Masai race to East Africa. The same arguments which have led observers to believe that the Masai came from the north and from Egypt, or perhaps even from Arabia, may also hold good in the case of the Watussi. As a matter of fact, many features common to both races may be discerned.

The Watussi are a tall, well-made people, with an almost ideal physique. Heights of 1.80, 2.00, and even 2.20 meters (from 5 feet 11½ inches to 7 feet 2½ inches) are of quite common occurrence, yet the perfect proportion of their bodies is in no wise detracted from. Whilst the shoulders are generally powerfully built, the waist is at times extraordinarily slender. The hands are elegant and delicate in form, the wrists of an almost feminine grace.

They possess that same graceful indolence in their gait which is peculiar to Oriental peoples, and their bronze-brown skin reminds one of the inhabitants of the more hilly parts of northern Africa.

Their heads are eminently characteristic. Unmistakable evidences of a foreign strain are betrayed in their high foreheads, the curve of their nostrils, and the fine oval shape of their faces.

The affairs of the country are administered by a number of subordinate chiefs (*watuales*), also *watussi* or *wahima*, who are superintendents of districts, yet are always subject to the supreme control of the ruler, who springs from the old Watussi race, the Bega. Frequent interviews with the Sultan necessitate many journeys to his residence, and it seems that at such times great quantities of *nsoga* have to be consumed, to facilitate the unraveling of awkward problems and to determine the measures to be taken. This is a brew concocted from bananas with malted red sorghum (Chinese sugar-cane), and manufactured at Kinjaruanda. The Sultan's court is at such times often the scene of wild orgies, tumult, and beating of drums, which on occasion continue all night.

Similarly to their sovereign ruler, the chiefs are descended from various distinguished families or clans. These clans hold land, pay taxes to the Sultan, are keen to avenge the bloodshed of kinsmen, and possess a totem—some object of adoration, which usually takes the shape of an animal or a plant.

THE PECULIAR TOTEMS

Every clan reveres a totem, which in Kinjoro is called *umuzimu*. Should the totem take the form of an animal, it is forbidden to kill or to eat such animals. This interdiction is closely connected with the widespread belief of transmigration of souls, for their creed teaches that the spirits of departed relatives enter the body of their object of adoration. The uncertainty obtaining as to which special totem the spirit of the deceased has entered makes it appear more prudent to the natives to abstain from slaying or eating any animals revered as totems; and doubtless this consideration gave rise to the prohibition.

In Ruanda the souls of the deceased rulers are believed to dwell in the leopard and to continue to torment their people in that shape.

The following are a few clans of the Wanjaruanda, with their totems:

The most widely distributed and most feared of the clans is that of the Bega; they have taken the toad as their totem. Another, the Wanjiginga, reveres the crested crane. The Bagessera worship the wagtail, or dish-washer. Farther away there is the clan of the Wankono, whose totems, I understand, are sheep and goats. The totem of the Bakora is the chameleon; the Wasinga's sacred object is a particular species of ox with a dirty brown-patterned hide; that of the Batwa, in the Bugoie forests, is the man-ape, and so on.

AN IDEAL CLIMATE FOR THE WHITE MAN

The high degree of civilization existing among the Watussi is assisted by climatic conditions. These are nearly ideal for an equatorial country. Intense heat is excluded by virtue of an average altitude of some 1,600 meters. The temperature prevailing generally is something like that of a warm summer day in Germany. It is refreshingly cool in the mornings and evenings, which is conducive to healthy sleep.

As the malaria-carrying mosquito (*Anopheles*) does not exist in this district, such a thing as an outbreak of fever is of rare occurrence. It is true that isolated malaria parasites are found in the blood of Ruanda natives, but these have doubtless been imported from less healthy regions, where the *Anopheles* is an acknowledged pest. According to Raven's researches, cases of malaria in Ruanda are insignificantly few in proportion to the density of the population.

The tsetse-fly, so destructive to man and beast, is non-existent, and this fact has, so far, protected the territory from the ravaging sleeping sickness which, as is well known, is disseminated by the tsetse-fly (*Glossina palpalis*).

The Watussi make the best use of their very favorable climatic conditions. The country possesses a fabulous amount of wealth in its herds, to the breeding of which this pastoral people are particularly devoted. Day after day immense herds of broad-horned oxen and small stock of all kinds may be seen grazing

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

A LIP ORNAMENT, CONSIDERED VERY BEAUTIFUL BY THE NATIVES

on the mountain slopes, for whom provision is made by continually burning away the dried-up grass. The young grass which shoots up from these burnt-out tracts forms a special delicacy. Stock-raising and the productivity of the country are greatly aided by the extraordinary number of small watercourses, which never run dry, even in the dry season.

From what I have written it will easily be seen that the greater part of Ruanda is eminently adapted for colonization by white men, and that cattle-raising on a large scale, and also agriculture, may be carried on in a remunerative way, for the quality of the cattle itself is as excellent as that of the milk they yield. As to the quality of the soil, it simply leaves nothing to be desired, so that it is evident that there is a splendid opening here for the establishment of business on a vast scale.

The entire region, however, is one which is quite unknown to the German government, and so it would be a very desirable thing if the state would decide upon sending out a commission, composed of agricultural experts, to examine into the conditions that exist. It would be necessary that an experienced forestry expert should be of their number, as the woods and forests question is an important one in Ruanda.

Ruanda, in conjunction with Urandi, is the most thickly peopled region of Central Africa. Its population has been estimated at one and a half millions. The great area of forest land has, however, been encroached upon by the increasing population, so as to provide sufficient space and pasturage for the cattle-rearing Watussi and for the agricultural activities of the Wahutu.

At the present day Ruanda possesses only two large tracts of forest on its boundaries: that of Rugege, to the southeast of Lake Kiwu, and the Bugoie forest country, which stretches from the northern end of the lake eastward. The remnants of ancient forests may be seen here and there on mountain tops; and, as these groves are regarded as sacred, they are therefore carefully maintained. They evidently mark the abodes of ancient tribal chiefs. The finest specimens of ficus are chiefly met with at these spots. Smaller groups of *Acacia abyssinica*—which, however, are very rare—may, says Mildbraed, be regarded as remains of pristine vegetation.

The great central portion of the country is entirely bare of trees. The question of fuel being one of the most important, as regards colonization, this matter should be inquired into at once. Time should be seized by the forelock and a judicious afforestation undertaken of those parts which most require it; for there is no doubt that we should not rest content with the railway systems already established at Lake Victoria—the gleaming rails must be pushed still farther ahead, so as to insure that we are not robbed of those rich territories lying westward of the lake.

OUR TROUBLES UNDER A BEE-TREE

On the 14th of August we set out from Lake Mohasi toward the west, our road leading us at first through the swampy end of the lake. To accomplish the passage, a huge quantity of papyrus stalks were cut and placed in layers. On this

swaying but reliable foundation even the mules were able to pass across safely. Then the usual load-humping recommenced, which was a painful and laborious business at first for our carriers, after their lengthy rest.

Near the village of Katschuri, on a hill overlooking the surrounding country, there stood a mighty tree whose colossal crown of foliage seemed to invite us to a shady resting-place. Some beehives peeped out here and there between the branches, full of a promise of sweet gifts. The place seemed made for us, so we were soon lying at our ease beneath the tree's friendly shade in full anticipation of a pleasant rest after our fatigues, while the Askari set about pitching the tents.

On a sudden I jumped up, startled out of my slumber by a painful sting behind my ear, followed quickly by another on my nose. A moment later Schubotz, who had just been watching my antics with a broad grin on his face, set up a cry of woe. Wiese, muttering maledictions, fumbled about in the air with his hands, striking out suddenly this way and that.

Then arms and cloths were waving and whisking about in every direction. "*Nyuki! nyuki!*" ("The bees! the bees!") was heard on all sides; and, just as if the swarming insects had waited for the battle-cry, the air was simply darkened by the vindictive little creatures. "Nyuki, angalia! ("Lookout!") nyuki!" The war-whoop resounded all over the camp. A fierce conflict raged for a few minutes, and then all was over.

Cries of pain were heard on all sides, and there was nothing but hurrying and scurrying and indescribable confusion. Those who endeavored to get their burdens into a place of security abandoned the effort and threw them down anywhere, and in a trice the whole crowd were flying down the hillside with the angry bees in hot pursuit. Others, and more shrewd, threw themselves down in the grass and remained motionless, and they alone were spared.

Greatly disconcerted, stung all over, and decidedly "taken down" at this shameful defeat, we met together again on the lower hillslope, where the enemy was still disputing the field. Wiese had the excellent idea of getting the Askari along and shielding their faces and hands with woolen blankets, so that the might get the loads away.

What a sight our camp presented! The loads scattered about, individuals

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THE SULTAN OF RUANDA AND CAPTAIN VON GRAWERT, THE RESIDENT

"The Sultan exceeds two meters in height (6 feet 6¾ inches)" see page 377

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE SULTAN MSINGA OF RUANDA ARRIVES, BORNE ON HIS PALANQUIN OR LITTER (SEE PAGE 377)

lying about here and there stretched out in the grass, the dogs howling and limping about on three legs, the fowls dead! The air was still filled with myriads of bees; they flung themselves angrily in dense droves upon the disturbers of their peace. The thick woolen armor, however, was almost sting-proof, and it was possible in a little while to bring the loads into a place of security. Yet it meant five hours' laborious work before a new camp was set up at a respectable distance from the first one. This little adventure gave us a lesson for the future. We never pitched our camp again under a bee-tree. The evening finished up with a violent thunder-storm, the first we had encountered in our wanderings.

AMBASSADORS FROM THE SULTAN BRING HUGE PRESENTS

Next morning the exhausted and suffering caravan met with a very strange surprise. A procession was descending the slope with such solemn gravity and in so calm and imposing a manner that the chattering of our carriers ceased as if by magic, and we all gazed upward, mute and spellbound.

Surrounded by a large staff of young men, two ambassadors from Sultan Msinga were slowly approaching our camp. They strode along with an indescribable self-possession and dignity, like apparitions from another world, clothed in the exceedingly picturesque gala costume of the Watussi. Bussissi and Nanturu were fine upstanding men of great height, over two meters (6 feet 6¾ inches). They brought the Sultan's greetings, and presents of numerous oxen, calves, sheep, goats, pigs, etc., and were commanded to escort us to their sovereign's residence.

The whole style and manner of their address and speech was very striking. One received the impression of being in the presence of an entirely different class of men, who had nothing further in common with the "niggers" than their dark complexion. The demeanor of our carriers, who appeared equally impressed, confirmed our view. Having received a goodly number of presents in exchange, the two emissaries placed themselves as leaders at the head of our column.

By the afternoon we reached the Niawarongo, a tributary of the Kagera, and finished our march for the day, for the crossing of the small cattle caravans, which had now increased to the size of several hundred animals, and the transport of the numerous loads lasted until the darkness fell. As the water scarcely rose above a meter, the work was simplified by forming a chain of men across the river. In this way all the loads and animals were safely passed from hand to hand, and so to the opposite bank.

We carried commissariat stores in abundance, and it was with a certain degree of anxiety that we observed day by day the increase in the number of live stock. The approach of a fresh commissariat caravan shortly after our arrival, with another reinforcement of about 30 goats, which had to be assimilated with the main body, increased our anxiety. But it would be difficult to describe our irritation when we saw yet a third caravan coming down the hill-slope with another string of 30 goats, which of course made a further inroad on our stock of barter goods. All protests against our acceptance of the gifts were quickly met with "*Amri ya Msinga*" ("By order of Msinga").

"THE GREAT OX ARRIVES WITH HIS CALVES"

The nearer we approached the Sultan's residence the larger grew the number of Watussi marching at the head of the expedition. We soon became aware that the Sultan was preparing a grand reception. In all the villages we passed the chiefs were absent, and to our inquiries as to their whereabouts we were answered by "Niansa." From all sides of the country commissariat caravans and herds of small cattle, led by Watussi, were heading in the same direction. It seemed as though the Sultan had summoned all the leading men of the kingdom to his residence. Many approached us and fell in at our van.

When acquaintances met, they greeted one another by putting their arms lightly

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE AUTHOR, THE DUKE OF MECKLENBURG, WITH THE TUSKS OF THE ELEPHANT KILLED ON THE SEMLIKI

Height of tusks: 2.53 and 2.51 meters (8 feet 3½ inches and 8 feet 2¾ inches). Weight: 98 and 94 pounds

around each other's waist or seizing each other's elbows. They remained in this position for a few moments. "*Amasho,*" one would then say ("I wish you cattle"). "*Amasho ngurre,*" replied the other ("I wish you women").

It can therefore easily be understood that expectation became more eager daily in our caravan. Every one looked forward to some remarkable and memorable incidents, and was impatient for the moment when he should be able to see the man whose name was a household word in Ruanda, whose word was law, and by whose sovereign will every one in the whole wide realm of Ruanda existed.

At length we reached the high-lying residence. Hundreds of Watussi advanced in front, increasing the already imposing dimensions of our caravan. A few high-born subjects were escorted by a number of carriers, bearing on their heads large baskets containing apparel and necessaries of life for the "master." Others even led a cow along with them, in order that a supply of fresh milk should be forthcoming.

Our arrival was watched from a distance, from the hill summits and elevated spots, by thousands of people, quiet in demeanor. No loud noise and clamor, no crushing throngs, as had been usual elsewhere, signalled our entrance. The behavior of the people compared most favorably with that of their kindred on the coast.

The intense eagerness with which the inhabitants of Niansa watched us, however, had also a special reason. The imagination of the people had been strongly stirred by the display of power which had been made, and which must particularly have been associated with my own personality. The immense supplies of provisions, the vast herds of cattle, which formed the presents from the Sultan, and the presence of Resident von Grawert, who came to meet us in full uniform—all this had made a tremendous impression on the minds of the people.

"The great ox arrives with his calves," flew the message from summit to sum-

mit. "He has four arms and six legs," which was meant less as a description of my personal appearance than the impression upon the pastoral mind of my power and might.

Thanks to Captain von Grawert's good offices, my camp was now most carefully and excellently laid out in a broad space not far from the Sultan's huts; for we were awaiting a visit from the "Mami."

THE SULTAN CALLS

Before "the mighty one" appeared, however, we were witnesses of a highly diverting scene. Great crowds of Wahutu had gathered round the camp. Their curiosity being aroused, they had flocked around and stared hard at the new arrivals. It was evident, however, that Msinga considered these masses of people would spoil the effect of his approach, for suddenly two forms clothed in red togas appeared upon the scene, staring fiercely at the crowd and swinging long staffs round their heads with very unmistakable intent, and they whirled them recklessly, with their full strength, into the midst of the people.

But the latter were apparently familiar with this maneuver, for at the same moment that the staff-bearers began to swing their weapons over their heads the whole mass was off in wild flight, and only a few laggards were struck. The square was empty in a trice. A few of the most curious, who ventured to return, had stones flung at them to drive them away.

A moment later the rolling of drums was heard from the palace, and then we were spectators of a unique drama, such as could only be enacted far from the beaten path of the ordinary traveler.

The splendid figures of the Ruanda princes, with their sons, marching in pairs, headed the procession. Msinga's palanquin, which then left the gate of the residence, followed slowly. Every one wore festive apparel, similar to that in which Nanturu and Bussissi had appeared. Their bodies were naked, but their hips were wound round by a narrow loin-cloth of tanned cowhide in two transverse folds, from which a number of strings of otter-skin or cowhide fell down to the ankles, which in their turn were adorned with various metal rings.

On their heads were hair-combs reaching from ear to ear, in which a thin pearl chain lay gleaming. Long yellow strings of banana hemp hung down in a copious mass from their necks to their breasts, on which pearl ornaments of varying sizes, called *mitako,* were fastened. Their wrists were encircled with bracelets of copper wire and glass beads of various color.

Thus the train approached my tent with measured steps and quiet, dignified demeanor. Our guard of honor for the Sultan—a non-commissioned officer and two men—presented arms. The Sultan's litter, a long, simple basket, the bamboo rods of which rested on the shoulders of Batwa people, was carefully lowered, and with the German words *"Guten morgen, Euer Hoheit,"* Msinga stretched out his hand to me.

The Sultan's figure, a little rounded in contour in consequence of his easy manner of life, exceeds two meters in height (6 feet 6¾ inches). One searches vainly at first for an expression of his vaunted intelligence, and an eye defect, coupled with strongly protruding upper teeth, emphasizes the unfavorable impression. Yet the questions which he addressed to me, and to those standing round, while reclining near me in a long chair, touched on the most various spheres of interest and bore witness to his keen, logical power of thought.

AN ENDLESS SUCCESSION OF GIFTS

After a lengthy conversation, which was carried on in the Suaheli tongue, and which touched on many topics, Msinga begged to be allowed to deliver his presents to me. This was a moment of great political importance and keen suspense to Msinga and his friends, as well as to his enemies, as the refusal of any portion of such presents would be a sign on my part that I was desirous of assisting the pretender to the crown, a relative of Msinga's, and that I wished to overthrow the reigning "Mami."

A tremendous gathering of people had therefore assembled behind the chairs on which we were sitting with the Sultan,

as well as opposite them, forming a lane, and awaiting the appearance of the gifts with painfully subdued excitement. And they came—came in endless succession.

In front was a milch cow, whose calf was carried behind. She was intended to represent the greatest honor that could befall me. She was followed by 10 oxen, with immense horns, and then a never-ending herd of goats. Flock followed flock, fresh contingents constantly rolling up and overflowing the cantonment. They were succeeded by an endless chain of heavy-laden Wahutu, with hundreds of loads, consisting of meal, milk, honey, butter, beans, and bananas.

After them appeared other trains bearing firewood, which was rare in the neighborhood and therefore particularly valuable. All these treasures were stored away in the camp, but the stock were driven into a hedged enclosure and placed under the guardianship of an Askari patrol. The procession had taken nearly an hour to pass by. Von Grawert himself, in spite of his lengthy term of office as Resident, declared that he had never before witnessed such an imposing spectacle.

WE DELIGHT THE SULTAN WITH A SAW

The great and overwhelming fear of a refusal of the gifts having passed, Msinga's court breathed freely again. The visit was at an end, and with solemn farewells the sovereign entered his litter and was borne away, followed by a forest of 500 spears. An ineffaceable impression!

The return visit in the afternoon was conducted with as much splendor as it was possible for a traveling caravan to offer. In addition to the ordinary gifts of stuffs and beads customary in the country, others were specially selected with the hope of "lightening up the countenance of the ruler" and rejoicing his heart. Any real equivalent to his own gifts was of course impossible.

Preceded by Askari with flying flags, followed by all the "boys," each carrying a present in his outstretched arms, and with horns blowing, we entered the Sultan's courtyard, which is brightly and cleanly kept, and passed on to the palace, which is bordered round by a hedging of wickerwork and papyrus. After an interchange of the customary greetings, and when we had taken seats, the presentation of our gifts took place. In order to heighten the effect, we ordered the "boys" up singly with their presents, so that they might be displayed to the best advantage.

The ordinary presents did not in the least excite the attention of the potentate; they were put aside with indifference or divided immediately amongst his head men. The clanging of an alarm clock, which had to be explained in every detail, pleased Msinga rather more, and his satisfaction grew into rapture when I handed him my hunting knife and a cartridge pouch filled with ammunition to fit the sharpshooter rifle which had been lent him.

But his enthusiasm reached its climax when I, with much solemnity, presented him with a saw, for which he had specially asked. After a few failures, he succeeded in sawing away the legs of my chair and operating upon everything else within reach with fairly good results. The "ministry," too, watched the experiments with the liveliest interest. The Askari, who were put through their drill and evolutions, gave considerable satisfaction, and this was heightened by the firing of a few rapid volleys.

THE REMARKABLE JUMPING OF THE WATUSSI

The following few days were devoted to sports and athletic exercises, of which the high jumping of the young Watussi was a most remarkable feature.

A line, which could be raised or lowered at will, was stretched between two slender trees standing on an incline. The athletes had to run up to this and jump from a small termite heap a foot in height. Despite these unfavorable conditions, exhibitions were given which would place all European efforts in the shade. The best jumpers—slender, but splendid figures, with an almost Indian profile—attained the incredible height of 2.50 meters (8 feet 5 inches), and young boys made the relatively no less wonder-

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

TREE-FERNS IN THE VIRGIN FOREST: KWIDSCHWI ISLAND, IN LAKE KIWU

The most attractive phenomena in the whole green shrubbery presented by the African virgin forest are the tree-ferns, which are found chiefly in clumps close to small watercourses. They are perhaps the most beautiful children in Africa's flora; with their slender stems, ten meters and more in height, and beautiful crowns, they are more like palms than ferns, and no layman would recognize in them a relation of our common bracken fern. The luxuriance of the undergrowth corresponded with the richness in species and variety of the lower animal world. . . . Earthworms of more than 40 centimeters in length, and fully as thick as one's thumb (*Benhamia* spec.), were extremely common. . . . The most striking feature, however, was the wealth of butterflies in this forest.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

PYGMIES OF THE GREAT FOREST, NEAR THE SEMLIKI RIVER

The pygmies are compact and strong in build; are very muscular; have round heads and short, curly hair. Big, intelligent eyes gaze out from good-humored faces. Their clothing consists of an apron of gray, woolly, beaten bark, which is obtained from the supa tree, and fastened round the loins with a belt of grass cord. Their place of residence changes according to their whim or hunting conditions, but is never to be found outside the forest boundary. The huts are carefully built of liane, covered over with foliage, which is scarcely proof against beating rain.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

PYGMIES OF THE GREAT FOREST, NEAR THE SEMLIKI RIVER

The weapons of the Wambutti consist of a bow and arrow and a short spear. According to their uses, whether for war or for hunting purposes, they are made of iron and wood respectively. The men forge or carve them themselves, and the arrows are all tipped with vegetable poison. From researches made by Dr. Max Krause, of the Berlin Hydro-Therapeutic Institute, it appears that the poison in these arrows is derived from a species of *strophanthus*, most probably *hispidus* or *kombe*, not *gratus*. After removing the poisonous coating for the purpose of investigation, it was found that the arrow was notched about three centimeters from the point, so as to favor its breaking off in the wound. The poison works rapidly, and is fatal in its effect unless the arrow-point is withdrawn very quickly and the wound sucked dry. Big game always succumb to its effects; death follows more or less swiftly, according to the particular position of the wound.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

CICATRISATIONS ON A MKONDJO WOMAN

The study of the tattooings and skin-markings found in the whole of Central Africa is an extremely remarkable one. It demands very great diligence and very special and detailed investigation to trace the origin and significance of the custom. For instance, Wiese found patterns which constantly recurred, but were frequently accompanied by changing side-marks among the hundreds which he copied. According to the statements of the natives, they betokened signs of lineage by which the various races recognized their own folk. The ornamental scarrings are brought about by an inflammation or artificial irritation of the skin, which is scratched or incised with a knife, according to the pattern desired. The wounds are smeared over with vegetable matter and dirt, which causes them to swell up to an extraordinary extent. We saw skin-puffings on the foreheads of the Bangala, the chief race of the Middle Congo territory, swollen up to about two centimeters. Countless variations may be found among which the half-moon shape occurs most frequently.

ful performance of 1.50 to 1.60 meters (5 feet).*

With Weidemann's assistance, I was enabled by means of an excellent cinematograph apparatus to obtain a few capital pictures of these noteworthy performances, and their reproduction in Germany aroused great interest.

Prizes in the shape of "gold" chains and similar objects were then distributed. The "Tait diamond" ornaments, which I had brought with me as special gifts of honor, found great favor with the trinklet-loving Watussi. Rings, stars, brooches, etc., were at length so coveted that my tent was in a continual state of siege, and I was obliged to keep my admirers at arm's length, so as not to exhaust completely my stock of "precious jewels."

We were also given an opportunity of seeing a set of dances, which differed in no material respect in their character from those I had watched in the Masai steppe and among the coastal tribes. There was no musical accompaniment to the majority of the 11 different kinds of dances which we observed, such as is usual with all the terpsichorean exercises of the negro people. In spite of this, however, there was no lack of rhythm. These dances were based on ideas borrowed from the animal kingdom, and were executed singly or in groups accordingly.

*The world's record for a running high jump is 6 feet 5⅝ inches.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

CONICAL HUTS OF THE WANGILIMA, ON ONE OF THE HIGHER TRIBUTARIES OF THE CONGO

I remember one dance, which was designed to illustrate the movements of a crane. We smile, no doubt, at these naïve native customs, but quite unjustifiably. We come across the same ideas in our highly cultured Europe, for what is the clog dance of the Upper Bavarian peasants but an imitation of the song and motions of the blackcock?

The war-dances, however, were of a different nature. These were carried out in groups, and we were able to distinguish different phases. Two parties would rush to attack each other, brandishing long rods and spears. Then a number of warriors would dance in a circle around a man who was bounding into the air with his arms held close to his body. Yet the movements were never wild; they never degenerated into those grotesque leapings and war-cries, or cadenced groans, so often met with among savage native tribes, but were always measured and dignified.

Each of the dances had been well practiced in the presence of one of the great chiefs. The Sultan himself had assumed the stage management of the joint dances of the chiefs. At the conclusion of each new phase, he never omitted to question me as to which group had best satisfied me, and I took good care that my replies should be as agreeable as possible to the ears of the ruler.

JAVELIN AND ARCHERY CONTESTS

Then a number of young Watussi exhibited their remarkable skill in javelin throwing. Taking a run of ten steps, bending backwards almost to the ground, they hurled their javelins up to almost prodigious heights, and with such impetus that two of the spear-shafts broke in the air from the vibration. It was the same with the shooting-matches with bow and arrow, in which the trunk of a banana tree was used for the butt. The shooting average at 50 meters was really good.

Great strength is required to bend the bow correctly, and to draw it to its fullest extent long years of practice are necessary. The elasticity of the bow, which is from 1.30 to 1.50 meters in

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

OARSMEN ON ONE OF THE UPPER TRIBUTARIES OF THE CONGO (FIRST POSITION)

These men were recruited from the Wabudu and Wangilima tribes—fine men, whose splendid display of muscle afforded evidence of perfect training. Their naked bodies shone with grease. They wore caps on their heads, made from the long-haired skins of apes, or tightly fitting bonnets smeared with grease and camwood, something like those used by our ladies at home when bathing.

height, is extraordinarily great, and with the bow-string drawn to its fullest extent the arrow flies a distance of 200 paces.

Running races, too, were organized, but owing to the lack of the necessary measuring instruments I am, unfortunately, not in a position to give the times. I have no doubt, however, that in this department, also, the European records were at least equalled.

IT IS NOT GOOD FORM TO LAUGH

The effects of a gramophone performance were curiously varied. Some listened and presented a most stoical indifference; others opened their eyes till they were as large as saucers, and the faces of others, again, were convulsed with delight. We had occasion here to confirm our former impressions namely, that our military marches aroused no interest, that unintelligible interlocutions caused general amusement, and that songs in a female voice, especially when they attained the higher notes, excited screams of laughter.

Laughter, however, was a slight source of trouble to the Watussi. It was not supposed to be "good form" to laugh, and it was intensely diverting to watch the frantic efforts made to conceal it, hands being placed quickly over mouths in order to hide any indiscretion. Then, after the merriment had passed, the delinquents would gaze quite gravely at the gramophone horn, until a suspicious twitching at the corners of the mouth rendered a fresh maneuvering of hands necessary.

The crowd continued to grow denser

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

WANGILIMA OARSMEN (SECOND POSITION)

Bending down low, the rowers dipped their finely carved copper-decorated paddles deep into the water, pulling them out again with a peculiar rapid jerk which made the canoe vibrate a little. The men are excellent, hardy river boatmen, who, with some encouragement, will persevere untiringly for hours at their work. While paddling they usually sing melodiously and with a purity and harmony of tone that I have seldom met with elsewhere. We all found this agreeable mode of traveling an indescribable relief after our exhausting marches through the primeval forest. Lounging in *dolce far niente* style, stretched on a comfortable chair under the protecting awning, we saw most luxuriant sylvan scenery pass before us in an ever-changing panorama. The boat we used was the common dugout canoe, and bore 20 oarsmen.

round the instrument, for the safety of which I was beginning to become nervous, when his serene highness suddenly hurled his long staff into the arena, making the splinters fly and ending the séance.

The Sultan being also desirous of seeing the white men do some shooting, an iron pot was placed on a stake and set up at a distance of 150 meters. As I, as well as others of my company, was successful in hitting this tolerably easy mark several times in succession, the plaudits from the crowd were great, and innumerable hands were stretched out in congratulation.

The Sultan, fearing that he would be beaten if he tried his skill from the same point, approached within 50 paces of the mark. His efforts were not exactly brilliant, yet every company captain would have been delighted with the faultless way in which he made ready and the precision with which he carried out all the movements. He was like an infantry man at the rifle butts.

The Sultan made me a further present of several objects of native industry. Yet the purchase of ethnographical material met with obstinate opposition. However, after some persuasion, Msinga gave his permission for goods to be bartered, and forthwith the whole population hastened from all quarters to enrich themselves by high prices for their wares. It

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

HIGH JUMP BY A WATUSSI (SEE PAGES 378 AND 382)

was principally through Wiese's efforts that we were enabled to get together a Ruanda collection such as has never before been seen in Europe.

At Niansa we received a visit from Father Class and Father Dufays, of the mission station of the White Fathers, who came along in company with Dr. Czekanowski. Long years of intimate intercourse with the natives enabled them to give us much valuable information relative to the inhabitants of Ruanda. The day before they had paid us a very delicate attention in the shape of a most welcome parcel of fresh tomatoes and vegetables. This was a great treat, our enjoyment of which could not be adequately appreciated save by Europeans who had suffered, like ourselves, from long deprivation of such luxuries.

If we were going to fulfill satisfactorily the various tasks we had set ourselves, it was now high time that we were once more on the move. So we resolved upon an early departure.

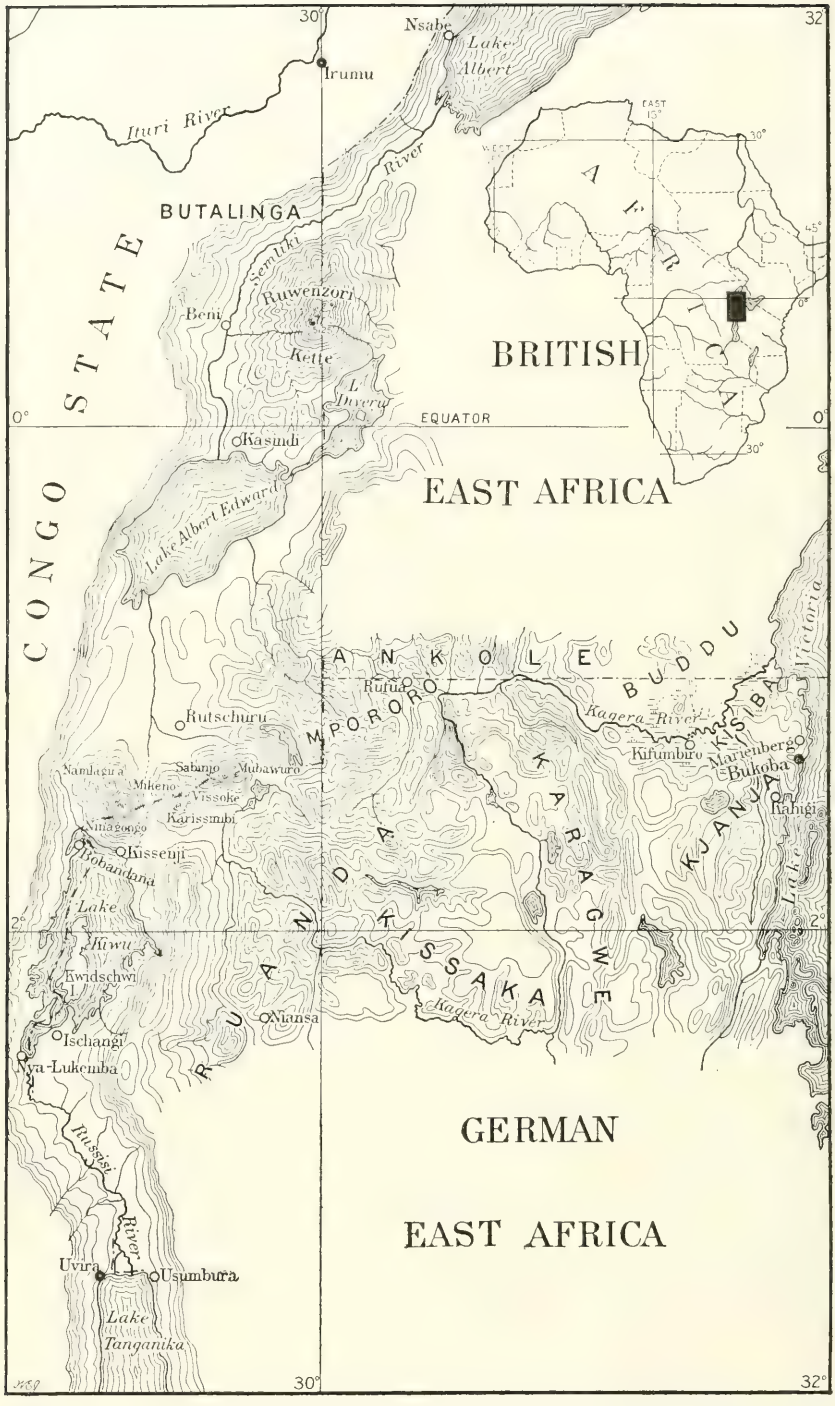
The most singular fact associated with our visit was that we never once came face to face with a Watussi woman. It appeared that they had been carefully guarded in their huts the whole of the time, so that they might not meet the eye of any of the "whites."

When we took our leave of the Sultan, at early dawn on the 12th of August, it was with a certain amount of satisfaction. We had been afforded an insight into the court life of a negro prince and favored with a display of his power such as no one had ever experienced previously or would probably ever experience again. When the illimitable power of this Sultan has receded before European influence, and when busy throngs of traders encroach upon the haughty aloofness of this most aristocratic of all negro tribes and the white man's herds graze in its pastures, then we shall be able to appreciate to the full the value of our remarkable experience.

From "In the Heart of Africa," by Adolphus Frederick, Duke of Mecklenburg (Cassell & Co.)

THE CHAMPION HIGH JUMPER OF AFRICA (SEE PAGES 378 AND 382)

"A line, which could be raised or lowered at will, was stretched between two slender trees standing on an incline. The athletes had to run up to this and jump from a small termite heap a foot in height. Despite these unfavorable conditions, exhibitions were given which would place all European efforts in the shade. The best jumpers—slender but splendid figures, with an almost Indian profile—attained the incredible height of 2.50 meters (8 feet 5 inches), and young boys made the relatively no less wonderful performance of 1.50 to 1.60 meters (5 feet)."



OUTLINE MAP OF RUANDA, "THE LAND OF GIANTS AND PYGMIES"

North of Ruanda rise eight gigantic volcanoes, which bear testimony to the mighty subterranean forces concealed beneath. Namlagira and Ninagongo are still active, and are the most interesting of this remarkable group. Dauntlessly their colossal forms tower up to the skies, 14,500 feet above sea-level, and not infrequently one sees the dazzling snow on their highest peaks gleaming under the tropical sun, only 100 miles from the Equator.

THE CORONATION OF HIS MAJESTY KING MAHA-VAJIRAVUDH OF SIAM

By Colonel Lea Febiger, U. S. Army

LAST December I had the pleasure of visiting Bangkok, the capital of Siam, as the military representative of the United States at the coronation of His Majesty King Maha-Vajiravudh. From nearly every nation of Europe there were special representatives. Members of the royal families of England, Denmark, Sweden, and Japan headed the legations from those countries. Our own Minister and those of several other countries were created ambassadors extraordinary for the occasion.

The actual coronation occurred Saturday, December 2, but was preceded the day before by a most interesting and gorgeous function at the Wat Phra Keo, the holy Buddhist temple within the palace grounds (see illustrations, pages 396 and 397). All woodwork inside and out of this temple was covered with gold leaf, and the walls were a glittering mass of colored bits of glass set in the stucco in designs. This ceremony was the blessing of the holy water to be used for the coronation, and was attended by all the court and diplomatic corps in full regalia.

The inside of the temple was so filled with priests that only members of the royal families, native and foreign, and heads of legations could be accommodated within, so the suites had seats on the entrance portico. They made a most resplendent aggregation of foreign uniforms and rich native costumes, those of certain native princes having over them a filmy lace coat heavily embroidered with gold.

This was our first view of the King. He wore a general officer's uniform, and was preceded by a number of lictors, or gentlemen in waiting, clad in quaint uniforms of light blue and silver, with a head-covering shaped like the ancient Tyrian cap. He was followed by a full hundred aides-de-camp in various glittering uniforms, the guards remaining outside the portico.

The coronation took place in the Dusit Maha Prasath Hall of the Chakkri Palace. This hall is shaped like a Maltese cross. The throne was at the intersection of the arms, all the foreign and native notables being assembled therein.

A few minutes before 12 o'clock His Majesty appeared, conducted by court chamberlains, and took his seat upon the throne, and at high noon, amid salvos of artillery and cheers from the populace outside, placed the crown upon his head with his own hands, having received it from his uncle, the Patriarch of the Kingdom.

After prayers by the Brahmin priests present, he received the homage from the various classes, each being represented by one member—the royal family first, then the military, civil officials, and members of the household. He then proceeded to the balcony to receive the homage of the lesser officials assembled without in the courtyard.

The King was dressed in a red uniform, profusely decorated with orders, and covered with cloth-of-gold draperies. The filagree golden crown was in the shape of a "prachidee," the tapering steeple with broad, round base, seen all over the land in connection with "wats," or temples (see illustrations, pages 394 and 395).* His Majesty then proceeded in state to the Wat Phra Keo, where he declared himself defender of the faith (Buddhistic) in the presence of the 80 chief high priests of the Kingdom. The priests presented an address and again blessed His Majesty.

This state procession was a most gorgeous, oriental, and dramatic pageant, well shown in the photographs, except that the startling and effective combinations of colors cannot be reproduced. The musicians were grouped by instru-

*See also illustrations in March, 1912, number of The National Geographic Magazine.

ENTRANCE TO THE KING'S WAT (TEMPLE) : BANGKOK, SIAM

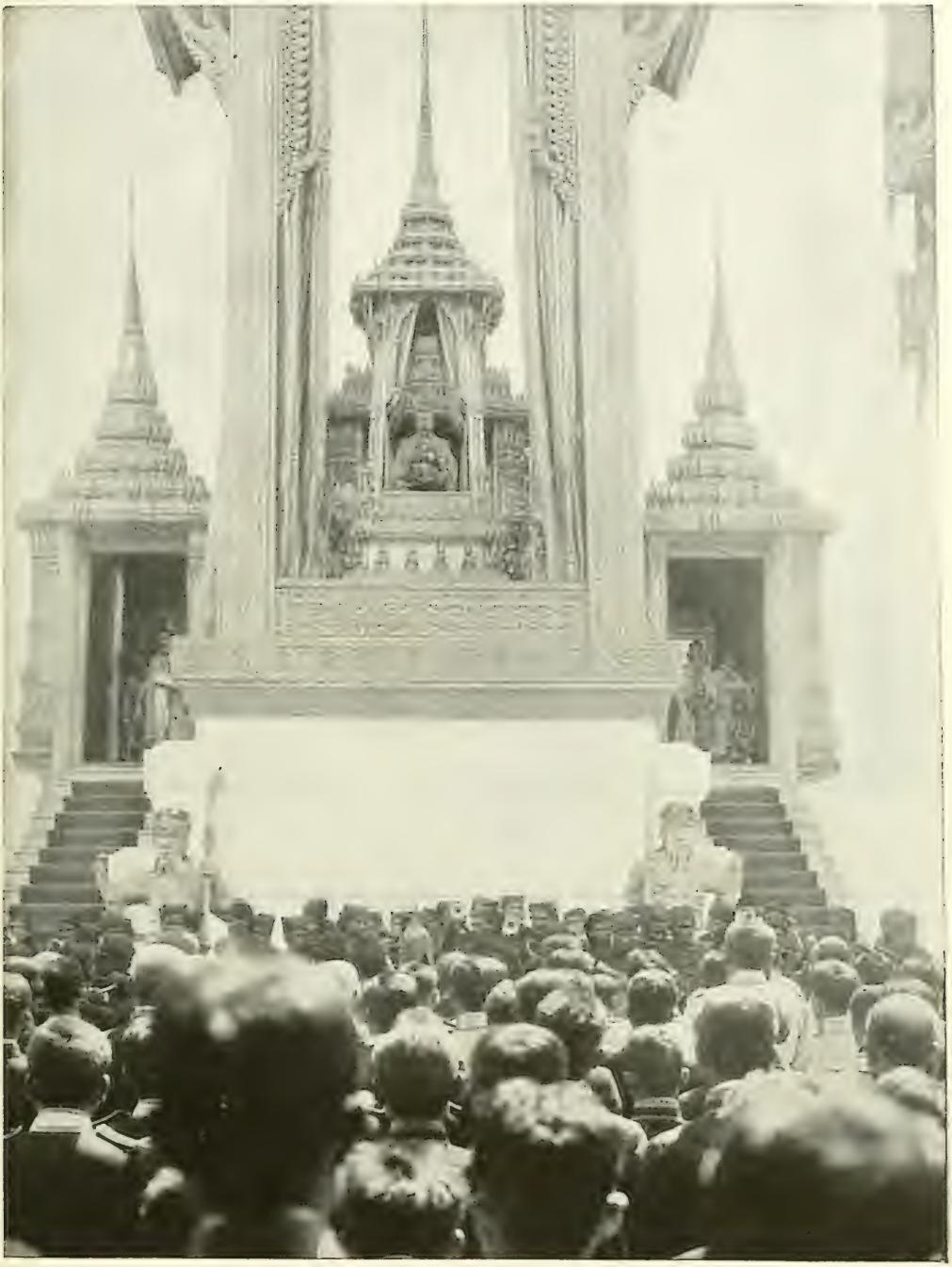


Photo and Copyright by R. Lenz & Co.

ON BALCONY OF THE DUSIT MAHA PRASATH HALL: THE KING RECEIVING HOMAGE FROM MINOR OFFICIALS IN THE COURTYARD

Photo and Copyright by R. Lenz & Co.

THE GOLDEN DRUMS AT THE HEAD OF PROCESSION CONDUCTING HIS MAJESTY TO THE WAT PHRA KEO AFTER THE CORONATION (SEE PAGE 394)

Photo and Copyright by R. Lenz & Co.

THE FIVE AND SEVEN-STORIED ROYAL UMBRELLAS IMMEDIATELY PRECEDING THE KING IN THE PROCESSION TO THE WAT PHRA KEO

Photo and Copyright by R. Lenz & Co.

THE KING BORNE IN ROYAL PROGRESS THROUGH THE CITY, SEATED ON A GOLDEN PALANQUIN

ments, dressed in dull red, with Tyrian caps. First came the golden drums (see page 392), followed by trumpets of ancient form, then those with conch shells. The noise was not music to foreign ears, but served to give the time. The dull thud of the drums, given every fourth step only, was weird in the extreme.

These were followed by a number of royal five and seven-storied umbrellas (see page 393), in various colors, preceding and following His Majesty, who was borne seated on a golden palanquin surmounted by the usual "prachidee" canopy, with 16 chamelion-looking bearers, who could barely shuffle along on account of the weight of their burden.

On the day after the coronation there was a royal progress through the city in grand state procession, in accordance with ancient custom. In addition to the various royal attendants, a division of about 11,000 troops took part. There were two gorgeous pavilions erected along the route, where His Majesty received addresses from the people and the European community before proceeding to Wat Bavaranives, where the King worshiped before the Phra Jina Siha, the ancient image of Buddha.

On Monday afternoon, December 4, there was another royal progress on the Menam River, in accordance with ancient custom, His Majesty proceeding to Wat Chang with offerings (see pages 402, 403, and 404). This was a most unique and impressive and charming sight. The quaint Oriental costumes—gorgeous red, blue, and cloth-of-gold uniforms of the guards and gentlemen at arms—made a perfect rainbow of color.

The King appeared squatting à la Buddha, on an uncovered golden palanquin, dressed in native costume of cloth-of-gold, wearing a very large broad-brimmed gray felt hat, caught up on one

Photo and Copyright by R. Lenz & Co.

HIS MAJESTY LEAVING THE PAVILION OF THE EUROPEAN COMMUNITY

side with a superb aigrette, and surmounted by a miniature copy of the "prachidee" crown (see page 399).

A double column of state barges, black lacquered, some with golden patterns, and propelled by paddles, manned by the navy in ordinary sailor's uniform, were a full hour in passing, all stopping to salute the King. Fifty paddlers were in each barge, with an officer and his guard under a red canopy amidships.

The King's own royal barge (see page 401) was of solid gold lacquer with filagree effect; the prow was the head and neck of a most remarkable-looking beast, a combination of a snake and a griffin, though it was called the "golden swan." There were 60 paddlers, in solid red, with queer close-fitting caps, with a cape behind and in front of the ears. As the King entered and left the barge, they in unison placed their hands in the position of Buddhist prayer and bowed over until they were doubled up and moaned. This they repeated three times.

The paddles were covered with gold leaf, and after each stroke they threw them up in the air, where the brilliant sun on the silver of the dripping water made a most beautiful effect. They all chanted at the same time.

Two similar barges, with large drooping white plumes instead of the swan's head, bore gifts to the wat they were en route for, under a scarlet canopy in the middle of the barge. It was very dignified and impressive. All the ships in the river were dressed, and the usual booming of salutes and music by various bands on the men-of-war in port were heard.

The afternoon of Tuesday, the 5th, the King received an address from the students of all the schools in a temporary pavilion at Thong Sanam Suang. This pavilion was a beautiful structure, with

THE WAT PHRA KEO, WHERE THE KING DECLARED HIMSELF THE DEFENDER OF THE FAITH (SEE PAGE 389)

THE KING'S TEMPLE, WAT PHRA KEO

All woodwork inside and out of this temple is covered with gold leaf, and the walls are a glittering mass of colored bits of glass set in the stucco in designs

Photo and Copyright by R. Lenz & Co.

HIS MAJESTY THE KING IN THE PROCESSION: NOTE THE SEVEN-STORIED ROYAL UMBRELLAS ON THE LEFT AND THE WHITE FIVE-STORIED UMBRELLAS ON THE RIGHT

Photo and Copyright by R. Lenz & Co.

THE KING ARRIVING AT THE PAVILION ON THE RIVER FRONT FOR THE WATER PROCESSION (SEE PAGE 393)

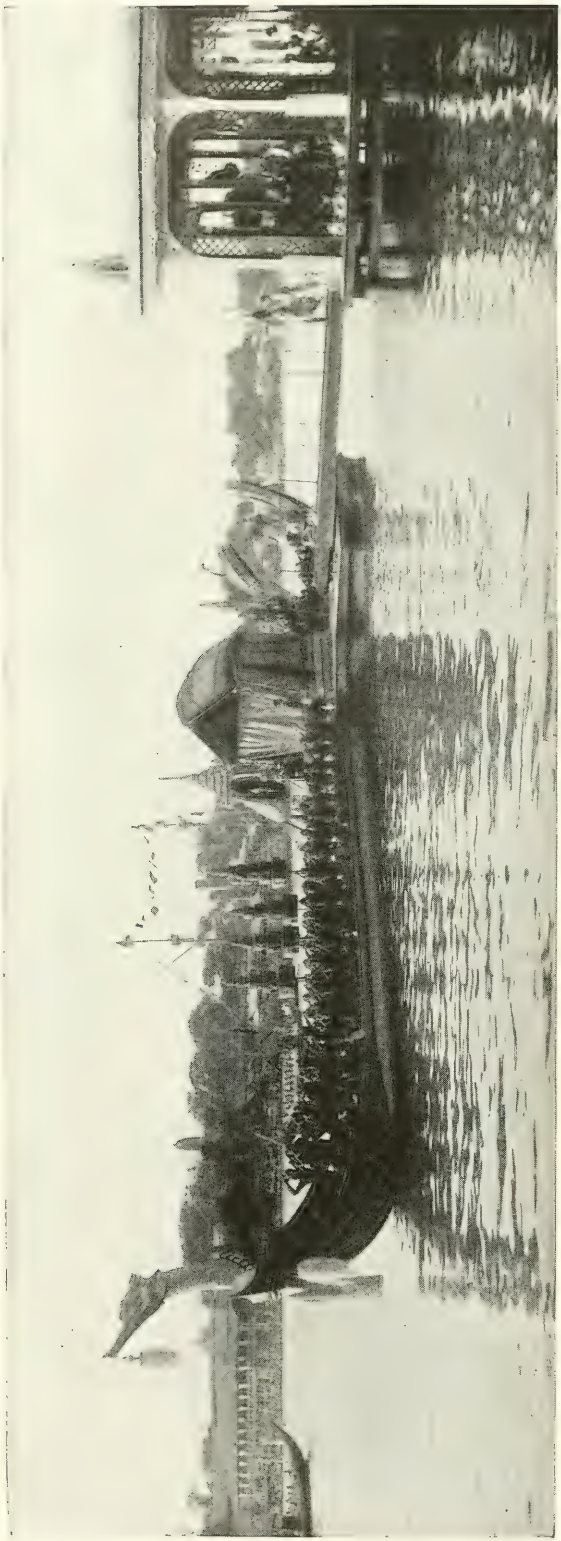


Photo and Copyright by R. Lenz & Co.

HIS MAJESTY EMBARKING ON THE ROYAL BARGE

red and cloth-of-gold hangings, the exposed woodwork following the same color scheme.

There were thousands of children, both boys and girls, grouped by schools. After the address the boys marched past in review. Most of them belong to Boy Scout organizations and wore the appropriate uniform, as much is being made of this movement in Siam.

That evening there was held a gala performance at the Theater Royal by the Royal Company of Masked Players in honor of the coronation fête, which only invited guests of His Majesty attended. It began at 10 p. m. and ended at 3 a. m., with an hour's intermission at midnight for an elaborate buffet supper.

I have never seen a more fairyland-like interior or a prettier house, the various-colored costumes of the ladies and brilliant uniforms of the men all spread out before one. The stage was lower than with us and extended way out into the audience, so that the parquet was on both sides as well as in front. The ceiling was composed of heavy white clouds of cotton, with openings for the electric lights to shine through.

Two plays were given, or rather acts from them. The action was entirely a ballet performance of Siamese dancing or posturing and slow, deliberate movements. The actors or dancers never spoke, but the tale was told by a sort of chanting Greek chorus behind the scenes. Both plays were allegorical, one an incident from their mythology and the other of the wars between the monkey people and the demons.

Photo and Copyright by R. Lenz & Co.

THE ROYAL BARGE OF SOLID GOLD LACQUER AND MANNED BY 60 PADDLES COVERED WITH GOLD LEAF: THE KING EN ROUTE TO WAT CHANG IN THE WATER PROCESSION (SEE PAGE 395)

THE GREAT TEMPLE OF WAT CHANG

COURT IN THE GREAT TEMPLE OF WAT CHANG

The Siamese claim that Buddhism is found in its purest form in Siam. It is the Buddhism of the southern school, which extended through Ceylon, Burmah, Siam, and Indo-China, and is comparatively free from those corruptions of the faith which are found in the Buddhism of the northern school, or Llamaism, as it might better be called. It must be acknowledged, however, that a great deal of Brahmanism has crept in through past ages, bringing in its train the superstitions which especially show themselves in the employment of astrologers to determine upon auspicious times for important events, and the part played by Brahman priests in all semi-religious festivals.

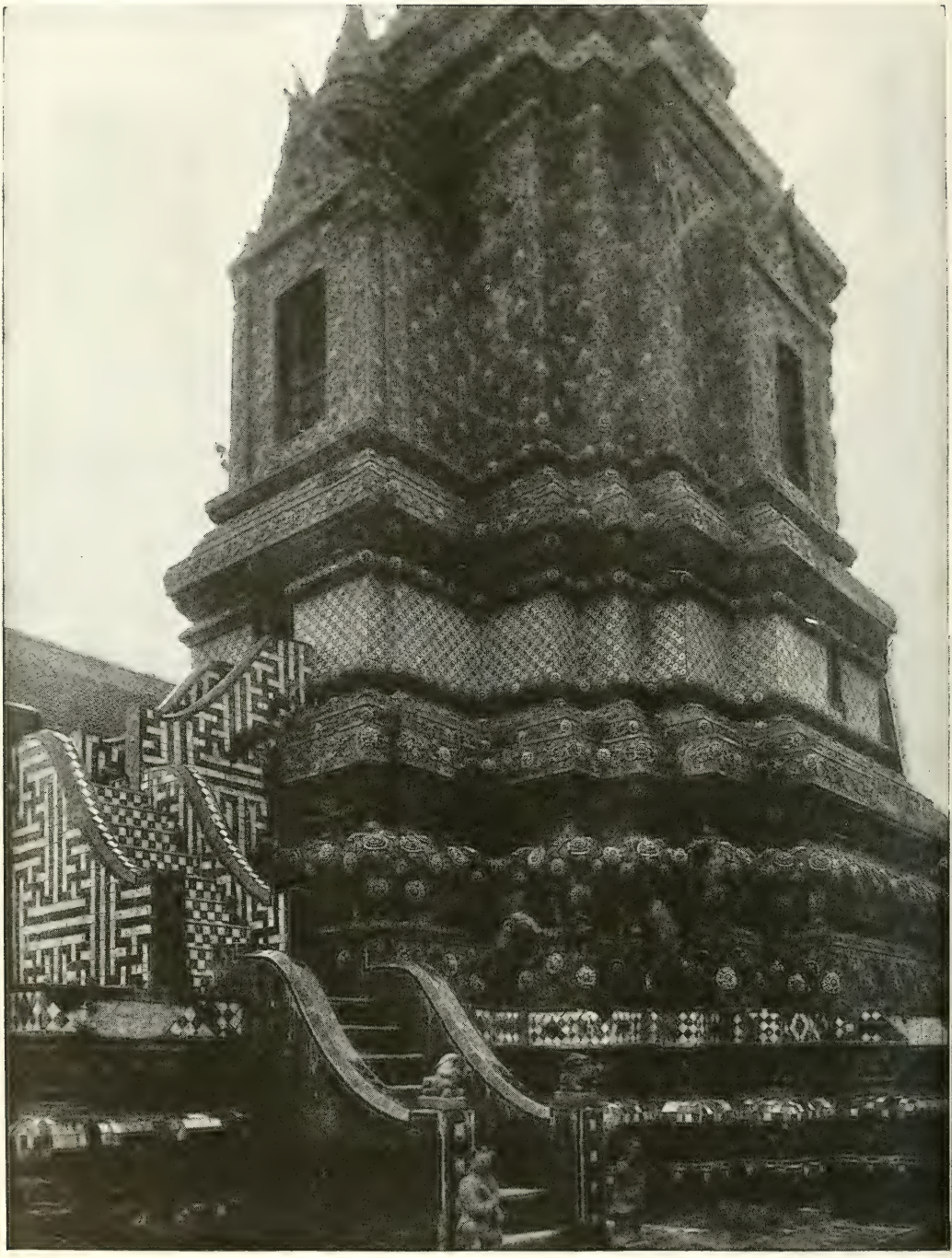
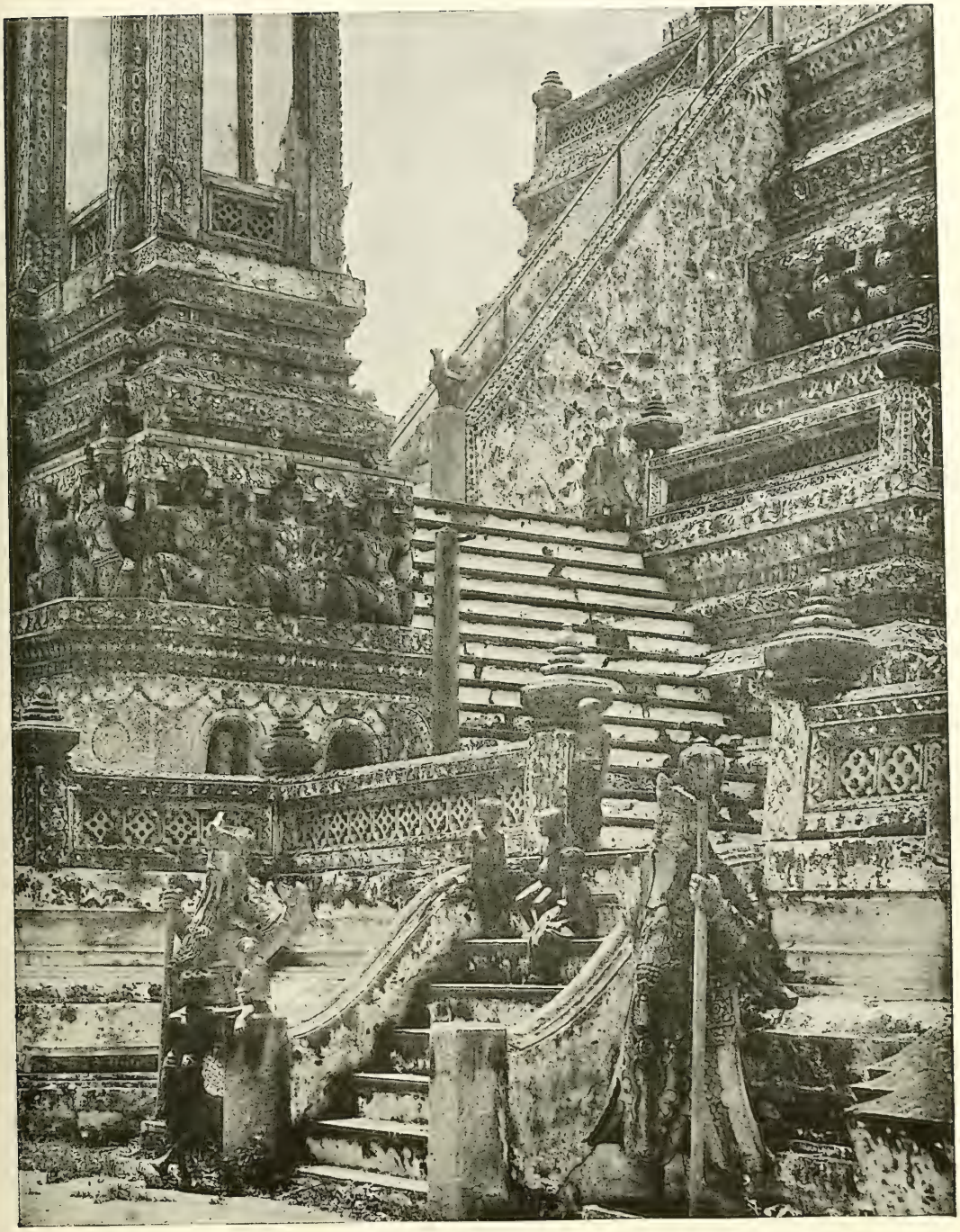


Photo from Lea Febiger

A DETAIL OF THE TEMPLE OF WAT CHANG



A STAIRCASE OF THE TEMPLE: WAT CHANG

SCENE WITHIN THE GROUNDS OF THE WAT PHRA KEO, THE MOST BEAUTIFUL TEMPLE IN BANGKOK (SEE PAGES 396 AND 397): NOTE THE ROYAL SEVEN-STORIED UMBRELLAS

ANOTHER SCENE IN THE WAT PHRA KÈO: BANGKOK

GATE TO ONE OF THE MANY QUAINT TEMPLES IN BANGKOK, SIAM

Siam has in the priesthood about 88,000 priests, 38,000 novices, and 71,000 boys in attendance, or a total of 197,000 devoted to religious work in a population of 6,750,000. The Siamese government is very progressive and is utilizing this great band of religious workers, which might otherwise be injurious, to educate the people in modern lines. Schools are being established in the temples with priests as teachers of elementary modern education, and normal schools are also being founded to prepare the priests for this work.

SCENE IN THE ROYAL PALACE GROUNDS: BANGKOK

Photo and Copyright by R. Lenz & Co.

REVIEW OF 26,000 SIAMESE TROOPS OF ALL ARMS: THE KING RIDING AROUND THE LINES

On Wednesday, the 6th, the ceremony of the presentation of new colors by the King to the various regiments of the army was held in the pavilion at Thong Sanam Luang. Each regiment was represented by a company. There was first a long chanting by the priests in blessing the flags, and then each colonel, supported by his color-bearer, moved forward and formed on three sides of a square directly in front of the King.

The colonels advanced one at a time, saluted, dropped on one knee, and received their colors from the King's hands, and then returned to their places. When all had been thus delivered, at a signal the colonels turned and gave the colors to the color-sergeants in their rear. All rejoined their organizations and marched past in review, with the colors on the review flank of each supporting company.

On Thursday was held the grand review in the Thong Sanam Luang field. It is not a very large space, yet 26,000 troops of all branches were massed in it in closed formation.

After the King had ridden around the lines, they were faced to the rear and, impossible as it seemed, still more densely massed to give space in front for the march past. This was very well done indeed, with beautiful alignments. They had a sort of modified "goose step" when passing the reviewing point, evidently

Photo from Lea Febiger

A PAIR OF ROYAL MASKED PLAYERS

Photo from Lea Febiger

GROUP OF ROYAL MASKED PLAYERS

taken from the Germans, and an exaggerated swinging of the disengaged arm to accentuate the time; they also took a very long step and marched very fast. It could not be kept up for any length of time.

After the march past, all the senior officers assembled, mounted, in front of the King, when the Minister for War (a prince of the blood) was promoted to the rank of field marshal and presented with a gold baton. The King's younger brother and heir apparent was at the same time made a full general of the army. Three hours were taken up by the ceremony.

That evening a reception was given by the head of the Ministry for War at the War Department building. About 4,000 troops marched past in a torchlight procession, and then filed into the inner court, where they performed various evolutions, making complicated figures of light, ending with an enormous outline of the royal crown.

In the early morning of Friday, the 8th, there was an excursion by rail in the King's luxurious private train, for such official visitors as desired to see the ancient capital at Ayuthea, some forty miles up the Menam River, and to Bang-Pa-In, the royal country palace. The appointments of the train and royal launches that met us were of the usual lavish and luxurious type, with every detail of hospitality.

In the evening a reception and exhibition of fireworks were given by the Ministry of Marine at the royal landing, near the palace, on the river. All the ships on the stream were decorated with electric lights. The daylight water parade was practically repeated, with the royal barges outlined in electric lights of various colors. The crews chanted a lauditory welcome to their ruler as they passed. The exhibition closed by there suddenly appearing from out the gloom, a mile or more down river, a beautiful white temple (Wat Chang), illuminated by colored Bengal fires.

On Saturday, the 9th, a grand muster by the Honorable Corps of the Wild Tigers was given on their club-house grounds. This corps is a sort of grown-up Boy Scout aggregation, and was instituted by the present King. They wear a similar uniform to the Boy Scouts. It is composed of office-holders and others who are not subject to conscription for the army, and is a purely volunteer association, with the King as its head. Wild Tigers was the native name for the ancient militia of the land, revived for this organization. There were fully 5,000 on the field, and as they would mass up at a run suggested, in their black uniforms with yellow trimmings, the swarming of a lot of bumble bees. A mounted detachment of them acted as special escort to the King, and were very effective, with tiger-skin saddle cloths and long lances with drooping white plumes midway of the shaft.

Next evening there was a reception at their club-house. The extensive grounds were beautifully decorated, a veritable dream of fairy-land. Each company—and there must have been at least fifty—had a booth where they dispensed drinks, food, and souvenirs to all their friends who called. The mounted company's booth represented a bivouac camp, with their ponies under nipa shelters. Another booth was an enormous prone papier-maché tiger, one hundred and thirty feet long. Entertainment inside. Another, just the head of a tiger, teeth, eyes, and claws, containing electric lights. The lake was covered with paper lotus flowers, electric lighted, and the drives and paths were a mass of lighted lanterns and bunting hangings.

This function closed the fêtes in honor of the coronation. During the whole gala week there was a continuous succession of elaborate dinners, luncheons, and receptions by the various officials. Two dinners were given at the palace by the King, with two hundred plates at each. The service was perfect.

Bangkok is situated thirty miles up the Menam River from the coast, and is hot at all seasons, though near the 15th parallel of latitude. It is in the center of an immense "paddy" (rice) field, extending in all directions to the horizon. This great extent of paddy country accounts for the nation, as rice is their

SIAMESE ACTORS

Photo from Lea Fehiger

THE TEMPLE OF WAT CHANG, ON THE BANKS OF THE MENAN RIVER, A MILE FROM BANGKOK

main source of wealth, *one million two hundred thousand tons* being the annual average crop, of which they export about one-half. The teak-wood industry from the forests in the north also add greatly to the country's wealth.

Bangkok is not unlike our own Manila, with the ancient city surrounded by a wall, only much of the wall has been demolished to make way for modern improvements. The inner wall around the palace grounds is, however, still intact. The crenellations on the top of the wall, instead of being the conventional square pattern, are shaped like the ace of spades.

The city is full of "klongs," or esteros, in former times the only mode of communication between sections, though now there are over one hundred miles of wide macadamized streets, constructed within the last ten years, where automobiles are much in evidence. I was told that the King has fifty-four for his own use and his entourage.

"Wats," or temples, take the place of convents and churches, and "prachidees" the place of spires. The "prachidee" is used almost as a national crest. The royal crown is designed from it, it is a part of the coat of arms, and is used like our eagle on their uniform ornaments. The erection of one near some temple is the favorite way of "acquiring merit," so dear to the Buddhistic heart.

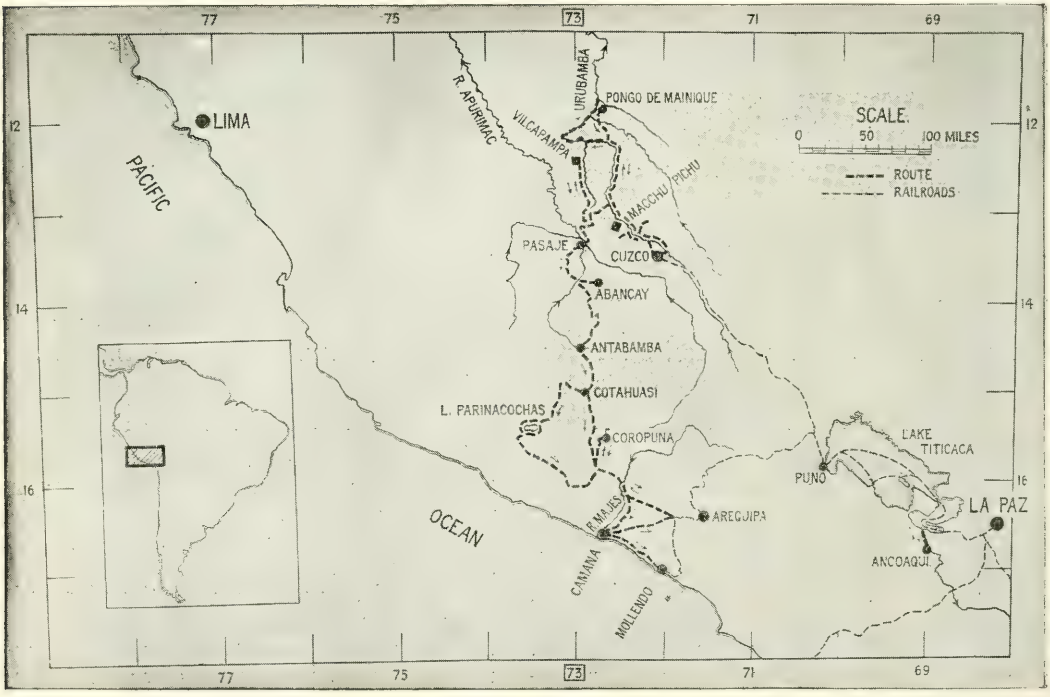
Men and women both, in all walks of life, wear the "panung," a piece of silk or cotton cloth about three yards long

and one broad, which is wound round the hips, the slack then rolled up and passed between the legs and hitched up behind. It gives the appearance of a pair of loose knickerbockers. The men wear a white or colored coat of European cut, and the women a jacket or blouse.

Though Siam is "The Land of the White Elephant," that animal was not at all in evidence in the various parades, though he is quite numerous in the upper or hill country, where he is used as a beast of burden. The only elephants in Bangkok were the five sacred white ones stabled inside the palace grounds, and they were not white—at least not to the casual observer—though when attention was called to it they had a sort of moth-eaten appearance around the head and ears, which was a lighter gray than the body, and they were reported to have some white hairs on back and tail. But they are not amiable, so were not closely inspected by me.

Practically all the royal family and many of the upper class are educated in Europe. All speak English perfectly, and many in addition French, German, and Russian.

A more courteous or charming people I have seldom met. Never having been a subject race, they have not that perceptible cringe observed in some Oriental people where the white man has been, or is, the dominant power. Their native name, "Thai," signifies "the free."



OUTLINE MAP SHOWING FIELD OF WORK OF THE PERUVIAN EXPEDITION OF 1912, UNDER THE AUSPICES OF YALE UNIVERSITY AND THE NATIONAL GEOGRAPHIC SOCIETY (SEE PAGES 417-422)

EXPLORATIONS IN PERU

THE National Geographic Society has subscribed $10,000 to the Peruvian expedition of 1912, to which the friends of Yale University have made an equal grant. The expedition is directed by Dr. Hiram Bingham, of Yale University, who was also director of the remarkably successful Yale Peruvian expedition of 1911, and will be known as "The Peruvian Expedition of 1912, under the Auspices of Yale University and the National Geographic Society." The researches and explorations of last year will be continued, the work centering in the Vilcabamba Valley and around Cuzco.

This region was the cradle of the Inca race, which became an empire 2,000 miles long, and reached a very high degree of civilization and culture. Comparatively little is known of its origin or of the wonderful Megalithic people who preceded them, and who built vast palaces and temples, which have endured to this day (see page 421).

In addition to the discovery of eight Inca and pre-Inca cities and temples, Professor Bingham found (1911) in a gravel bank in Cuzco the bones of the thighs, hip, ribs, and a portion of the skull of three human beings. The bones appeared to be interstratified with gravel of glacial age and may be the remains of men who lived 20,000 to 50,000 years ago. Other bones were also found, one of which appears to be the bone of a bison, the first recorded evidence of bison south of Mexico.

"The proof of the antiquity of this man," says Richard Swann Lull, Professor of Vertebrate Paleontology at Yale University, in the *Yale Review*, "lies . . . in the geological evidence offered by Professor Bingham that the remains lay at the bottom of a mass of stratified gravel, which covered them at one time to a depth of not less than 125 feet, a fact which, he rightly argues, points to glacial origin. Just what that means in the light of man's antiquity in Europe is not so clear, for it is not yet possible to correlate with any assurance a glacial deposit in South America with the measured advances and retreats of the great ice-sheet of the Old World.

"A conservative estimate of at least 20,000 years has been given as the probable age of the Cuzco man, a mere fraction of the duration of time since the appearance of *Pithecanthropus* (ape-man), or the man of Heidelberg or Neandertal; but whether the age be 20,000 or 60,000 years, if this discovery, which should be amplified by further exploration, will bear the test of time, its importance is paramount as the first authentic physical record of man's existence in the prehistoric western world."

Where did the bones come from? This question can be answered only by a careful geographical and geological study of the Cuzco basin and its vicinity, with special reference to the age of the gravel deposits where the human and other remains were found. Seldom do we find geographical and historical problems so intertwined as they are in Peru. Only a careful geographical study of the region can solve the many mysteries which are now puzzling the historian, the anthropologist, and the archeologist.

The Peruvian expedition consists of Hiram Bingham as director; Herbert E. Gregory, Silliman Professor of Geology in Yale University; Dr. George F. Eaton, Curator of Osteology in the Peabody Museum of Yale University; Albert H. Bumstead, for seven years topographic engineer in the United States Geological Survey; three assistant topographers, a surgeon, and three general assistants. A topographic map on the scale of two miles to the inch, with a contour interval of 100 feet, of the Cuzco basin, and also a detailed map of the entire Vilcabamba country, will be immediately made.

Dr. Bingham will continue the work, so successfully inaugurated in 1911, to discover and identify the places mentioned in the Spanish chronicles and in the early accounts of Peru, particularly the places connected with the 35 years of Inca rule after the advent of Pizarro. As many of these place names have changed, it will be necessary to identify the places by a careful comparison of their situation and surroundings with the itineraries and descriptions given in the chronicles. An attempt will be made to penetrate still further into the jungles of

Photo by Hiram Bingham

ONE OF THE MANY SUPERB MOUNTAINS OF PERU: MOUNT COROPUNA AS SEEN FROM THE HEIGHTS ABOVE ARMA, SHOWING ROAD DESCENDING TO ARMA

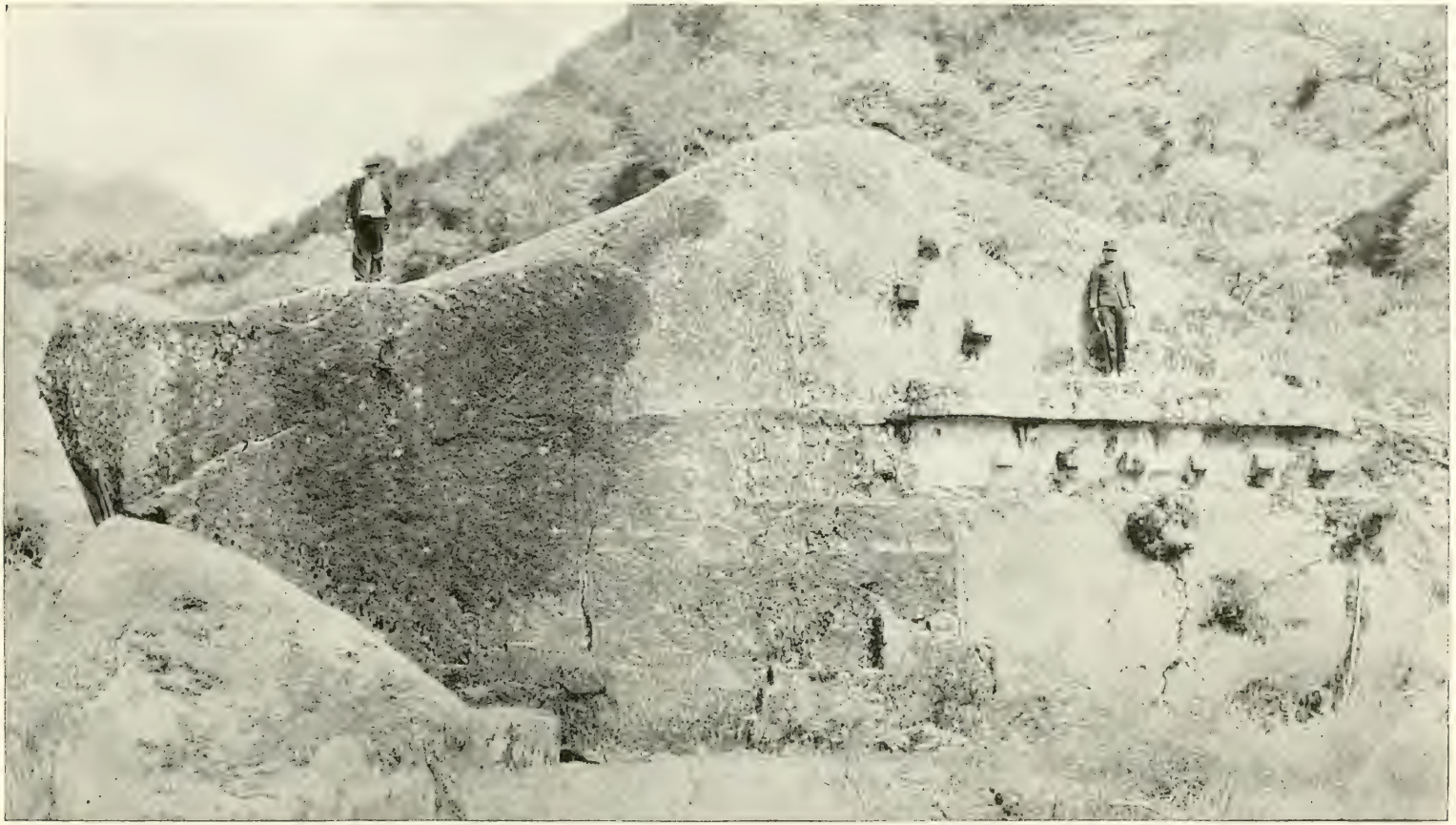
Photo from Hiram Bingham

ANOTHER VIEW OF COROPUNA

The mountain was ascended by Hiram Bingham in 1911. A careful survey and triangulation of the mountain from its vicinity to the seacoast by the Yale expedition showed that its real height is 21,703 feet—1,000 feet less than had been previously credited to it.

Photo from Hiram Bingham

A VOLCANIC BOULDER COVERED WITH PICTOGRAPHS IN THE VALLEY OF THE MAJES: PERU



THE GREAT CARVED MONOLITH OF YURAKRUMIU

Photo by Hiram Bingham

The temple here was the center of the Inca religious cult after the capture of Cuzco by the Spaniards. The site of the town and the monolith were discovered by Hiram Bingham on his Peruvian expedition of 1911

Photos by Hiram Bingham

THE RUINS OF MACCHU PICHU, A CITY PROBABLY BUILT BY THE MEGALITHIC RACE, WHO PRECEDED THE INCAS: DISCOVERED BY HIRAM BINGHAM ON HIS 1911 EXPEDITION TO PERU

The ruins are on an almost inaccessible ridge, 2,000 feet above the Urubamba River. They are of great beauty and magnificence and include palaces, baths, temples, and about 150 houses. The huge blocks of white granite, some of them 12 feet long, were so carefully cut that they match perfectly. Though no mortar or cement was used to hold the stones together, the walls have withstood the elements for at least 2,000 years. The stone against which the man in the upper cut is leaning is 13.2 feet in length and about 2.8 feet in thickness.

A VIEW OF THE INTERIOR OF THE TEMPLE OF THE THREE WINDOWS, LOOKING NORTH: MACCHU PICHU

The monolith is grooved at its top, evidently to support a wooden rafter

Photo by Hiram Bingham

INCA POTTERY AND STONEWARE RESCUED FROM THE JUNGLE AND NOW USED IN THE MANUFACTURE OF SUGAR

The notebook was put in the picture to give the pots a sense of proportion. It measures 4¾ inches in width and 7⅝ inches in length. The stone on the left with a round hole in the middle was found covering a grave, bottle shaped and lined with stone, in which nothing else of importance was discovered.

the Pampaconas Valley and beyond, to see whether any more remains of Inca occupation can be found.

Mr. Bingham has made a specialty of South American researches. In 1906 he explored the route of the great General Bolivar, in his famous campaign of 1818, from the heart of the llanos of Venezuela across the plains and the Andes into the heart of Colombia. A four months' journey on muleback carried the party from Valencia, in northern Venezuela, across Venezuela and Colombia to Bogotá. The return trip was made by way of the Magdalena River. The journal of this expedition has been published by the Yale University Press under the title "*The Journal of an Expedition across Venezuela and Colombia.*"

In 1908 Professor Bingham made an overland journey from Buenos Aires to Lima, following the route of the Spanish traders in the colonial period. The account of this expedition was published by Houghton-Mifflin Company under the title "*Across South America: An Account of a Journey from Buenos Aires to Lima by way of Potosí, with Notes on Brazil, Argentina, Bolivia, Chile, and Peru.*" The chief interest of this trip lay in its being an exploration of the most historic highway of South America. The more difficult parts of the road had been used by the Incas and their conqueror Pizarro; by Spanish viceroys, mine owners, and merchants; by the liberating armies of Argentina; and finally by Bolivar and Sucre, who marched and countermarched over it in the last campaigns of the wars of independence. Information was collected regarding the South American people, their history, politics, economics, and physical environment.

On this journey, at the invitation of the Peruvian government, Professor Bingham explored the ruins of Choqquequirau, an Inca fortress in the valley of the Apurimac. His study of these ruins in a region hitherto unexplored led him to desire to penetrate still further into this country, which is one of the most inaccessible in the Cordillera.

Vilcabamba was chosen by the last Incas as the safest place in which to rule without being disturbed by the Spaniards, who had conquered the larger part of Peru. This almost inaccessible labyrinth of grand canyons, tropical jungles, and glacier-clad mountains is the scene of his present work.

THE MAJESTY OF THE MATTERHORN

VOL. XXIII, NO. 5 WASHINGTON MAY, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

THE WHITE SHEEP, GIANT MOOSE, AND SMALLER GAME OF THE KENAI PENINSULA, ALASKA

BY GEORGE SHIRAS, 3RD

AUTHOR OF "PHOTOGRAPHING WILD GAME WITH FLASHLIGHT AND CAMERA," "ONE SEASON'S GAME BAG WITH THE CAMERA," AND "A FLASHLIGHT STORY OF AN ALBINO PORCUPINE," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

FOR a number of years the writer had in view a trip to northwestern Alaska, to study the big-game animals and certain varieties of non-migratory birds, and where the camera, rather than the rifle, was to capture the permanent trophies of the hunt.

Experience had shown, long before, that it was not how far one traveled away from home, or how extensive and primitive the country, which necessarily meant success in the pursuit of wild life. Well illustrating this are the virgin forests and the burnt-over, second-growth country immediately north of Lake Huron or Lake Superior, now largely deserted by the fur traders, the Indian trappers, and numerous camp-followers.

Here one may find a greater variety and abundance of big game in a week, and sometimes in a single day, than might be encountered during an arduous canoe journey of several months on any of the many open streams leading from the lake country to Hudson Bay. All these waterways have been traveled for centuries and the remaining game driven back into distant quarters. Because of the inhospitable winter climate, the lack of proper food conditions and shelter, most of the big game in Ontario, except caribou, is found on the southern watersheds draining into the Great Lakes.

So with Alaska. The reports of miners, trappers, government explorers, and sportsmen, covering many years of persistent research, have shown very clearly that the mere distance traversed in this vast country often meant but little in regard to big game, since it was a matter of ordinary occurrence for persons to travel a thousand or more miles on the Yukon and some of its tributaries without seeing a single specimen of the larger animals.

One might also journey for a month with a pack-train into the interior, crossing the rough and sodden tundra, the willow-tangled swamps, climbing over the rock slides of disintegrating mountains, cutting out trails along the thicket-rimmed banks of the larger streams, or wading waist deep the swirling, ice-chilled waters flowing from the melting snowbanks and glaciers of the upper valleys, and during all these long days of unremitting toil and miles of steady progress only a few grouse or an occasional porcupine might fall to the rifle of the weary and ever-hungry traveler.

OUTLINE MAP OF ALASKA, SHOWING THE SECTIONS THAT HAVE BEEN MAPPED AND SURVEYED

This because the caribou is a wandering and uncertain animal to find in such a limitless country; because the moose frequently remain concealed for months during the summer in thickets of alder and willow at the edge of the timber line; because the bears, besides being largely nocturnal, hide most of the time in the densest jungles or feed high up the slopes on the tender grasses and wild berries until the coming of the salmon; because the sheep and the goats habitually occupy the higher ranges beyond the valleys of the larger streams.

Thus unless a side hunt is made back and up into the game country, one might often think that interior Alaska was a barren and tenantless waste, did not the old tracks in the clay bottoms and higher sandbars faithfully register the former visits of the hoofed and clawed animals of this mysterious and little-known wilderness.

AN IMMENSE COASTLINE

To one who has not followed a portion of the Alaskan coast, with its tens of thousands of islands, deep bays, extensive promontories, and countless channels, where the main shore for miles is walled in with precipitous glaciers or by the highest mountains, and who has not also penetrated sufficiently into the interior to understand the changes wrought by the difference in climate and topography, it is difficult to present a clear and adequate outline of this great area and its diversified conditions.

The general contour of the coast is known to many and its devious channels to a lesser number of experienced navigators. Where the interior is opened up by navigable streams or where the valleys and low divides allow the use of the pack-trains or the sleds and the adjacent mountains permit an unobstructed view, sometimes exceeding a hundred miles in circumference, it naturally follows that sufficient data has been obtained to dot and trace the small scale maps with an imposing array of mountains, lakes, glaciers, well-defined river-courses and tributary streams.

But, excluding the coast survey, less than 20 per cent of the interior is mapped, and detailed surveys represent a very minor portion of this (see map, p. 424).

Until a permanently organized topographic corps is permitted to plan and pursue its work in a continuous and systematic way, instead of hurrying from one part of the country to another, as the mining camps or other interests seek assistance, the interior of Alaska can be known only in a fragmentary way from the early surveys of the War Department and the later records of the Geological Survey, which in recent years has done such splendid work in locating and appraising the mineral wealth and possibilities of the country and in suggesting the most feasible routes for its development.

One main difficulty in presenting a general geographic view of our last remaining continental Territory is not because it exceeds 600,000 square miles, or on account of its remoteness, but because Alaska is the most complex and irregularly shaped area of the size in the world. A good example is the Kenai Peninsula, which, with a total length of 150 miles, has a shore-line of more than 1,000—and a glance at the map, pages 428 and 429, will explain the reason.

Alaska lies on either side of the Arctic circle, is in both the Western and Eastern hemispheres, by reason of its westerly extension, and possesses a coast-line of 26,000 miles, exceeding the aggregate of the United States on the Atlantic, Gulf, and Pacific shores if we include in such survey the deeper indentations and the various groups of islands, one of which, the Alexander Archipelago, embraces more than 11,000 islands. The narrow chain of the Aleutian group extends, at right angles, more than 800 miles and within eyesight of Russian territory, where when the sun is setting in June it is rising on the Maine coast.

PHYSICAL AND CLIMATIC DIVISIONS

There are two comparatively distinct ocean areas on the Alaskan coast, separated by the Alaska Peninsula and its segmented extension, the Aleutian chain, which, largely intercepting the northerly flow of the Japanese current, also create marked climatic differences.

South of this barrier the warm current keeps the subarctic harbors open all the year; the humid air, coming in con-

tact with the snow-covered coastal ranges and the glacier-filled valleys, produces a most extraordinary precipitation in rain or snow according to the season.

To the north, Bering Sea remains clogged with floating ice well into summer, and when the open water finally permits navigation to the Yukon delta and beyond, the warm moist air of the Japanese current, passing freely over the Aleutian chain, comes in contact with the cooler waters beyond and creates a dense and almost perpetual summer fog. Sometimes it may take several days to find and effect a landing on the Pribilof, or fur-seal islands, and then, like as not, the islands are finally located by the cry of the seal pups or the pungent odors from the breeding rookeries.

In a similar way the land area of Alaska has two distinct divisions. To the south and the east of the Alaska Range the country is rugged and mountainous, with valleys great and small and rivers swift and numerous, as necessary incidents, while to the north and northeast it is low and rolling, the streams more sluggish and separating into many channels on approaching the Pacific and Arctic coasts. Climatically the interior cannot be divided so readily. At the same altitude and period it is warmer in summer than on the coast and much colder in winter, the local variations occurring in the mountainous country, as might be expected, where the elevations range from 2,000 to 20,000 feet.

Of the two big-game animals particularly sought on this trip, one, the moose, was to furnish, if successful, a valedictory chapter of its many years' observation, and in the most westerly and northerly of the five districts into which the writer had endeavored to divide the continental range of this animal,* and the other was the beautiful white sheep of the subarctic mountains, a variety with which I had no personal acquaintance, but now desired to cultivate in an entirely friendly way.

To stalk, study, and photograph for the last time the largest, most unique, and impressive of our antlered animals, and then when this was accomplished to seek out on the rough mountain tops the snowy descendants, or perhaps in reality the progenitors of the Big Horn sheep of the Rockies, constituted a program sufficient in itself, though plenty of sensitive plates were in reserve for any other animals or birds worthy of portraiture.

To obtain satisfactory results from a first and rather brief exploration into a new and unsettled country, I think as much depends upon the comparative accessibility of the game field as upon the comparative abundance of the game itself.

The Kenai Peninsula, lying between Cook Inlet on the west and Prince William's Sound on the east, distant 1,500 miles from Seattle, was selected as not only the most accessible in territory and in the abundance of its game, but because in this favored region the moose and mountain sheep reached their highest perfection in physical development and, what was of equal importance, were to be found with certainty in well-defined ranges in this semi-island home.

THE KENAI PENINSULA—A MINIATURE ALASKA

It is seldom that a small, semi-detached portion of a large and diversified country can satisfactorily portray the whole, not only in the romantic history of its discovery and early explorations, but in those present-day conditions, where the climate, topography, and economic resources excite attention and comparison. Were all of Alaska erased from the map except the Kenai Peninsula and its immediately adjacent waters, there would yet remain in duplicate that which constitutes the more unique and that which typifies the whole of this wonderful country.

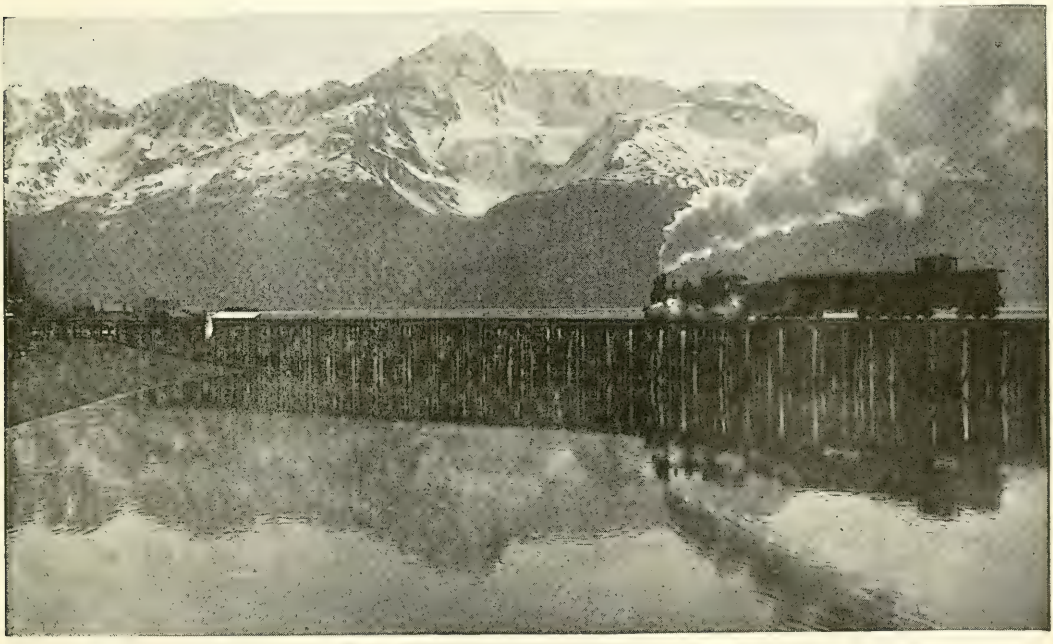
This is true of its tribal races and mixed descendants, of the hardy pioneers in well-governed settlements, where with the best of harbors, a railroad leading to the interior, steamships and cable lines to the outer world, they enjoy nearly all the advantages of modern civilization.

It is true, too, of the forests, herbage, wild fruits and flowers, the game and commercial fish, the native and migra-

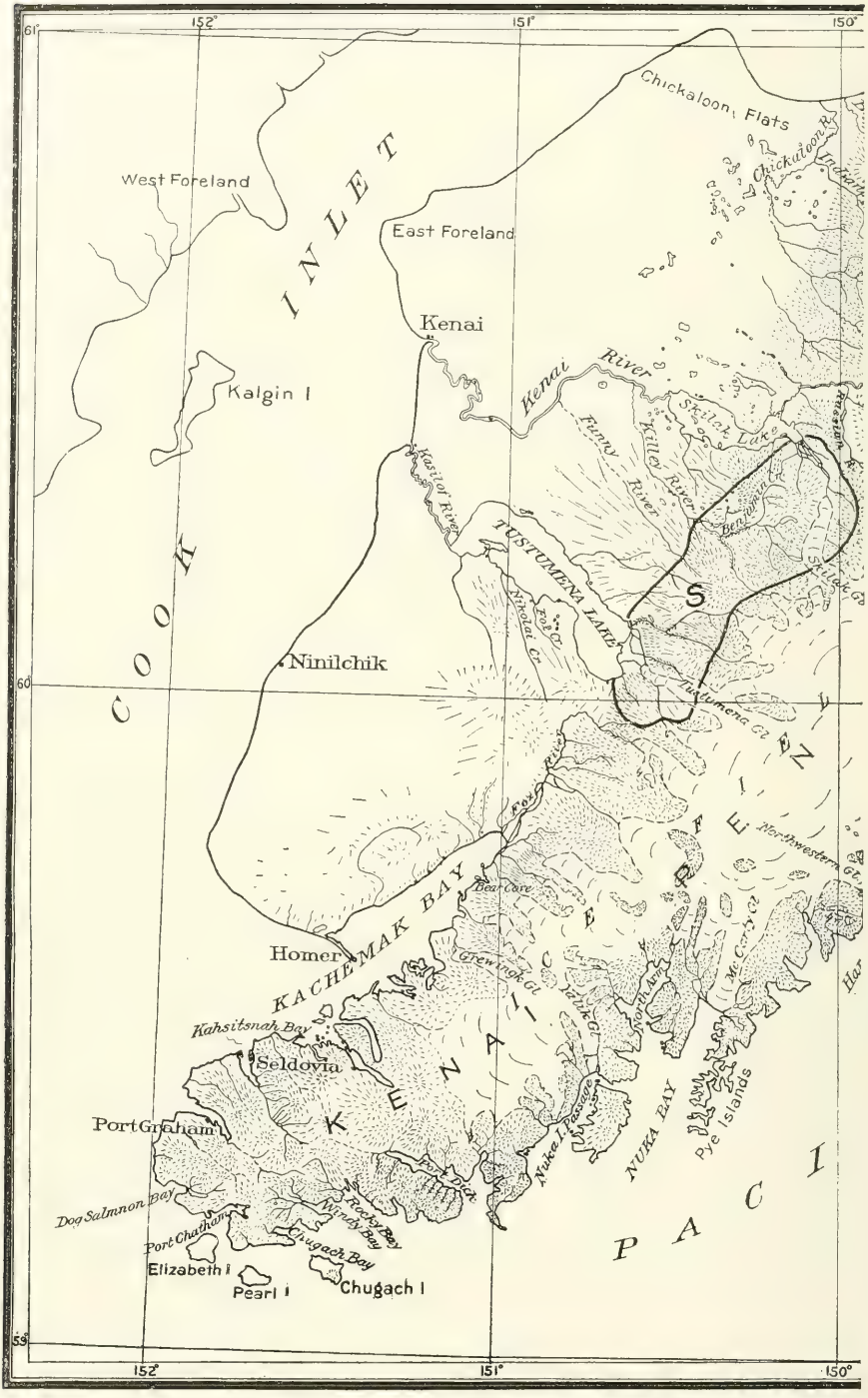
*See articles by George Shiras, 3rd, in the National Geographic Magazine, 1906 and 1908.

HEAD OF RESURRECTION BAY, SHOWING THE TOWN OF SEWARD

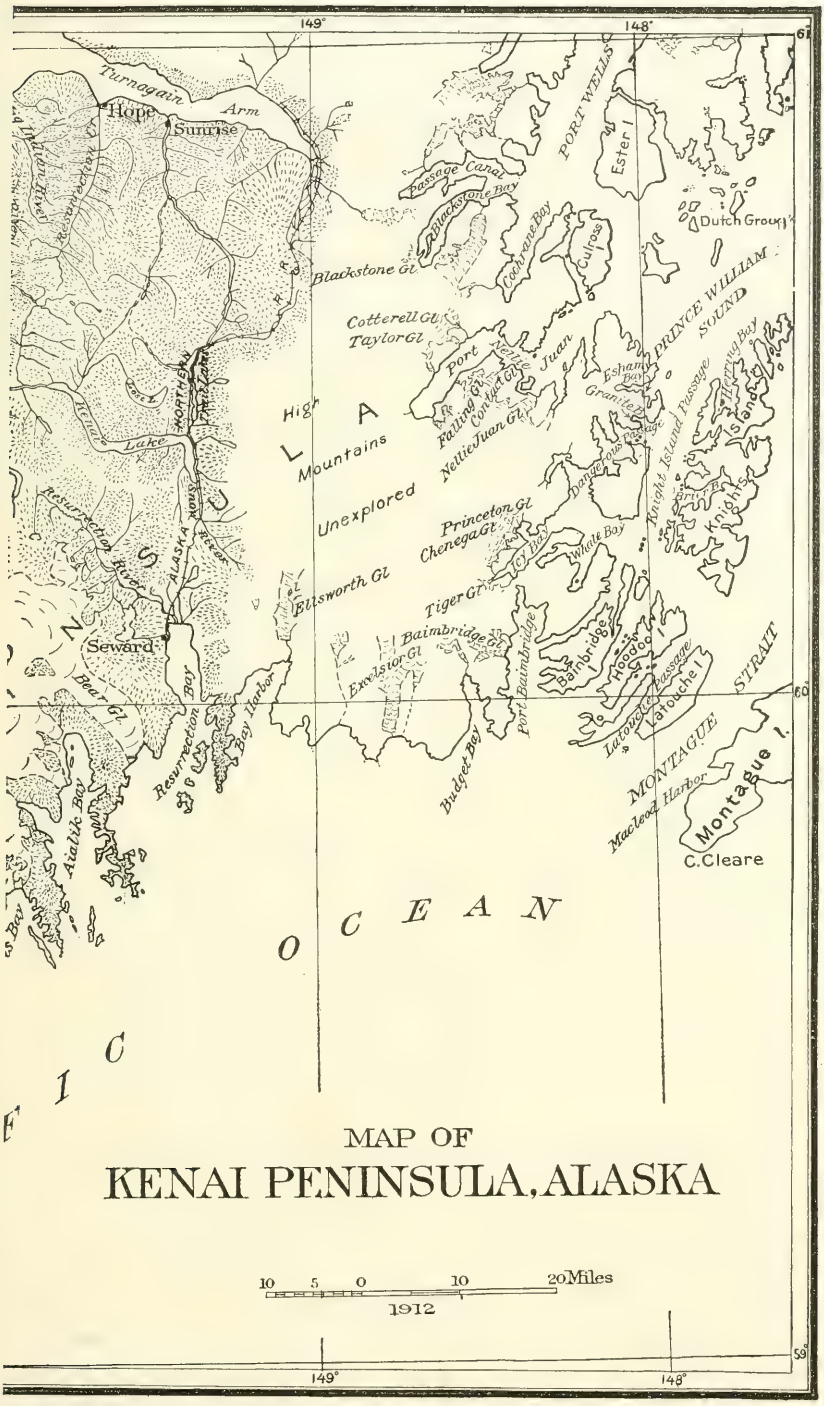
The cross to the north indicates the position of upper Kenai Lake, and 40 miles to the westward was the hunting ground of the author (see map, pages 428, 429)



RESURRECTION BAY, SEWARD PENINSULA: STEAMSHIP DOCKS OF SEWARD, WITH TRAIN LEAVING FOR KENAI LAKE AND TURNAGAIN ARM (SEE PAGE 430)



MAP OF KENAI PENINSULA, SHOWING THE BEST PORTION OF THE SHEEP COUNTRY (ENCLOSED IN A BLACK LINE AND MARKED "S")



MAP OF
KENAI PENINSULA, ALASKA

AP OF KENAI PENINSULA, SHOWING LOCATION OF SEWARD AND RESURRECTION BAY.
COMPILED BY R. H. SARGENT BY REQUEST OF GEORGE SHIRAS, 3RD

THE MAJESTY OF THE MATTERHORN

tory birds, the big-game animals and smaller fur bearers, the minerals and methods of mining, and in the magnificence and variety of the scenery, represented in well-defined mountain ranges and isolated peaks, the foaming cascades, the giant glaciers and ice fields, the rivers and intervening lakes, and the hundreds of unexplored fiords of the eastern and southern shore.

Here and there snow-capped mountains drop to plateaux, rough and shaggy in crimson coats of moss or yellow-barked willows, and further down the green coniferous forests touch the tundra, dotted with glistening ponds, the feeding place for moose and the home of the black fly and mosquito.

Here during the summer solstice are weeks of brilliant weather and periods of wet and fog, while the frequent seismic disturbances give notice how superficial are the ice fields and the blizzards in a country of great volcanic energy.

Here is a mid-year season, when the calendar days are separated by an hour of twilight, and again when the trapper, in his sheltered winter cabin, cannot see the sluggard sun above the horizon of the surrounding mountains.

Here are tidal waves and rip-raps of Turnagain Arm, like those of the Bay of Fundy, and here so rare the atmosphere that at times Mt. McKinley, distant 200 miles to the north, can be seen from the higher mountain tops.

So many accurate and graphic accounts have been written of trips along the Alaskan coast that any effort to duplicate or vary the same may be dispensed with here.

On leaving Lake Superior and at the last moment I was obliged, owing to sickness in his family, to get a substitute for my old Michigan guide, John Hammer, who for 25 years had accompanied me on various trips. Charles Anderson, who took his place, had frequently been employed by me in various capacities, and possessed a fair knowledge of the woods and waters.

On July 8 we left Seattle for Seward, and had pleasant weather throughout most of the voyage.

Toward sunset on the evening of July 14 the steamer entered Resurrection Bay, which penetrates deeply into the Kenai Peninsula, forming the most wonderful harbor on the Alaskan coast and open throughout the winter, when the Great Lakes and connecting rivers are closed for many months.

After a run of ten miles between two snow-covered ranges paralleling the bay, we reached the town of Seward, and the first responding to the shrill and echoing whistle were a hundred or more dogs, of every breed and color, who amicably ranged themselves in several compact rows along the edge of the dock, in hopes that some portion of the garbage saved by the kindly steward would fall to their lot (see page 431). In their home grounds or street fronts these shaggy beasts maintain a dead-line against all canine intruders, but at the wharf there was no distinction based upon race, size, sex, or relationship. Whenever a steamer whistled at night, or any unusual noise aroused them, the wolf-like howl, rising and falling in chorus, told plainly of the near kinship of many of these to the gaunt and ravenous creatures of the forest and rocky gulches.

On disembarking we were met by an obliging inn-keeper and soon were in earnest confab with our local guide, Thomas B. Towle, who had just come in from his mining camp, on the upper Kenai River, with the information that a launch would meet us at the lake, two days later, on the arrival of the motor train.

At Seward so varied and reasonable are the supplies needed on a camping trip that little need be brought from the outside, while the courteous and reliable character of the inhabitants, private and official, makes the entry and return to this little town a source of pleasure and kindly recollection. In fact this may be said of most Alaskans, for their trials and struggles, like placer mining, have removed the rough and undesirable from their midst.

On the morning of July 17 we boarded a gasoline car of the Alaskan Northern Railroad, en route to the upper Kenai Lake, 23 miles to the north, while the canoe and bulk of the provisions were to be forwarded by freight several days later. The railroad in question extends

Photo by George Shiras, 3rd

WINTER SLEDGE DOGS LOITERING EXPECTANTLY AROUND STEWARD'S PANTRY (SEE PAGE 430)

to the end of Turnagain Arm, half way to the Matanuska coal fields; but, lacking sufficient capital and by reason of the withdrawal of the coal lands, is now in financial straits. However, it is a most convenient highway for hunters and miners, and if either of these lack the cash to pay the tariff of 20 cents per mile or are of an economical turn of mind, the roadbed affords a fine trail to the interior.

On arriving at the lake it took but a few minutes to load our stuff on a comfortable launch, and soon we were traversing a portion of the longest watercourse of the peninsula, which from the head of Snow River to Cook Inlet is 117 miles in length. The upper lake is 23 miles long, has a maximum width of 1.5 miles, and is 460 feet above sea-level. The upper Kenai River is 16 miles long, while the lower lake, usually called Skilak, has a length of 15 miles, is four or five miles wide, and 150 feet above the sea, its waters reaching the inlet after a tortuous run of 53 miles.

At the outlet of the lake we transferred the outfit to Tom's big flat-bottom skiff, and, dropping down the river several miles, went into camp at the mouth of Cooper Creek, to await the arrival of the canoe and provisions. The maximum temperature was 80 degrees at noon, followed by 87 degrees the next day—a most unusual record.

Seeing that the half-embedded boulders were sweating vigorously along the river trail, I predicted a big thunderstorm, and was warned that they were very rare in this region. But shortly after the rain came down in torrents and thunder echoed for hours throughout the valley; so I gained that distinction which comes with a lucky hit. This proved to be the only heavy rain of the entire trip, and thereafter clear days and a high temperature pleased and astonished us all.

STERN FIRST, DOWN THE RAPID KENAI RIVER

As usual on expeditions of this kind and where the supplies could be carried by water, my outfit was varied and heavy, for it is the height of bad management, when visiting a remote and unsettled country, to economize in money, time, or labor at the expense of a proper equipment or an ample supply of provisions.

Several hours were spent in loading the boat and canoe, with just a sufficient separation in kind to leave a complete but temporary outfit in case either craft was capsized on the run to the lower lake.

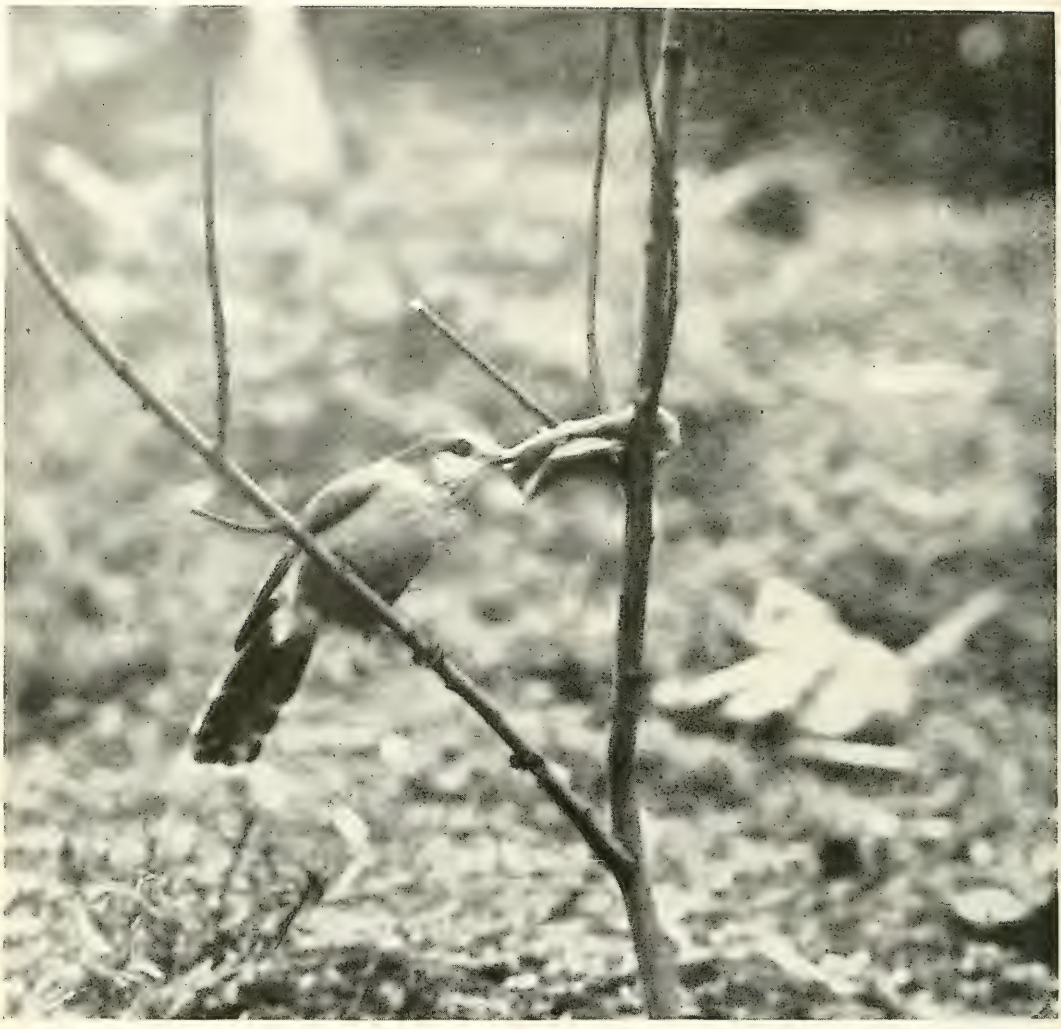


Photo by George Shiras, 3rd

THE ALASKA (?) OR CANADA JAY: THE MOST TYPICAL NON-GAME BIRD OF THE NORTHERN WILDERNESS

The above is a photograph of a non-migratory and Northern jay, taken on Skilak Lake, and which, as a species, is indigenous to the upper wilderness from Newfoundland to Bering Sea and southwardly to the lower provinces and most of the border States. While tame and fearless to a degree toward casual visitors, it dislikes and avoids permanent human habitations, single or collective. It is a bird, too, of many local names—whiskey jack, moose bird, camp robber, and meat bird. Originally classified as the Canada jay (*Perisoreus canadensis*), the effort now to differentiate the Alaska bird, on a minor if not a variable color phase, is regarded as a mistake by most lovers of the North woods. If there is any bird on the American continent of similarly extended distribution and localized environment which retains a greater and more remarkable uniformity in color, size, shape, habits, basic notes, diet, and disposition, the writer is ignorant of such. The sub-species, Labrador jay, ought to be the limit in this direction.

The clear, warm weather, with an unusual amount of winter snow remaining on the mountain ranges, had caused the river to overflow its banks. The rapid current now made it possible to cover the 16 miles to the lake in a few hours, and this condition had prevented any boat coming upstream for several weeks. It may be stated in advance that the hot weather continued until the first week in September, and so, on our return, it required four days of the hardest

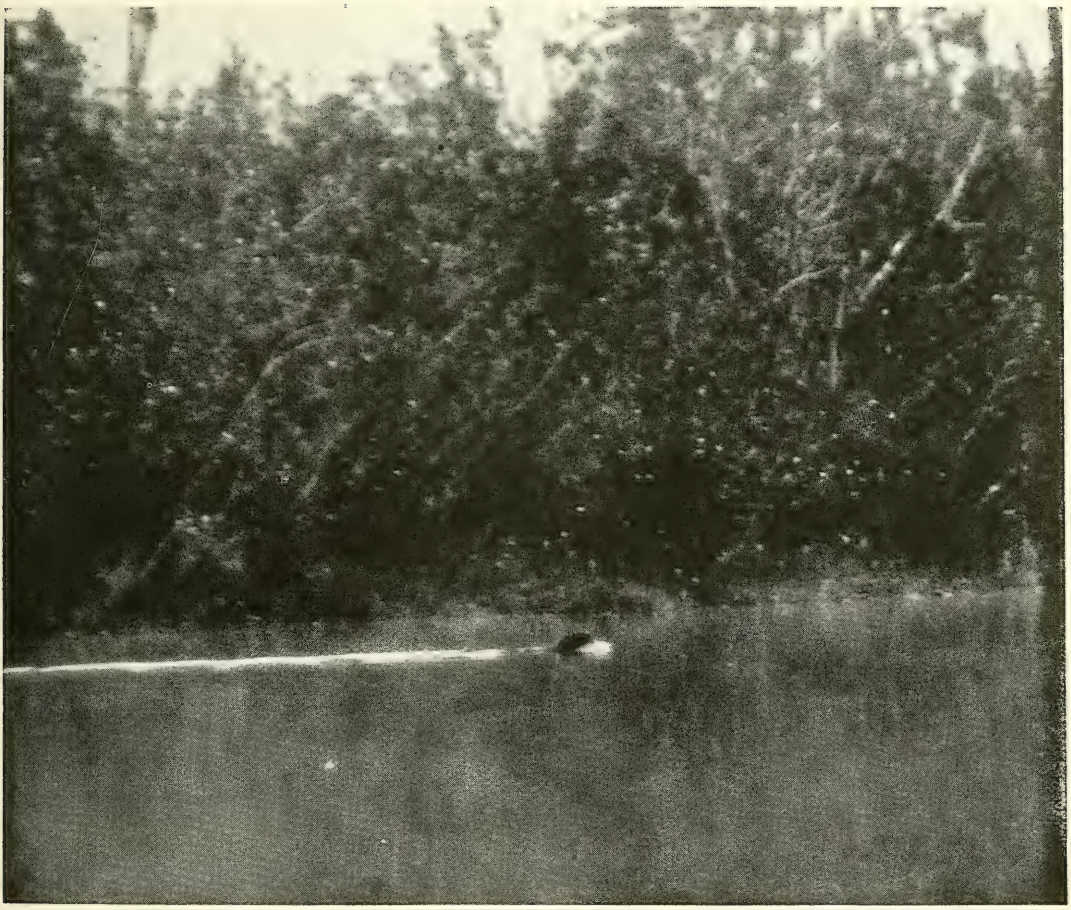


Photo by George Shiras, 3rd

OTTER SWIMMING IN A BAY OF SKILAK LAKE, SEEKING SALMON: THE OTTER SWIMS WITH HEAD HIGH OUT AND BODY SUBMERGED

kind of work to line up the skiff, the canoe having been abandoned in order that the three men might devote their energies to the larger boat.

And even at that date we were the first to get up the river, due wholly to Tom's skill and the energy of all.

On the short trip from the outlet of the upper lake to our first camp, at the junction of Cooper Creek and the Kenai River, I found that it was the invariable practice for all boats, big or little, to go down this stream stern first, and to me this was a new method of navigating swift and dangerous waters. Heretofore I had boated on many such Northern streams, originally in the frail and buoyant birch-bark canoe, in dugouts, and, later, in the modern canvas-covered cedar ones, or at times in the knock-down type, as well as having occasionally used the big, strong, sharp-pointed batteaux of the Hudson Bay and Newfoundland kind, which could plunge with impunity into the roughest water; or, when sufficiently manned, could be lined up any stream, irrespective of inshore rocks and snags.

But whatever the craft or the character of the water, bow first was the rule, except when a mishap in the breaking of an oar or the slipping of a rope decreed otherwise.

Therefore, to load down a small, frail, flat-bottom, square-stern skiff with 1,000 pounds of stuff and two occupants, and then start down the river wrong-end foremost, where every 100 yards or so

Photo by George Shiras, 3rd

A HOARY MARMOT

The northern type of the American woodchuck—a good example of protective coloration. Photographed on mountain at head of Benjamin Creek

the combers in the narrower channels, or cross-currents, throw the waves a foot or two higher than the stern of the boat, seemed inviting catastrophe, had it not been proven otherwise, seconded by the fact that Tom had the reputation of being the most capable and experienced riverman in the Kenai Valley.

Grave concern was expressed, however, over the safety of our canoe, and so the feeling of distrust was mutual. Tom said that he would rather take his chances on a saw-log, "Because it never took in water, and the part above the surface was always the top, no matter how often it rolled over." So here was a chance to try out the efficiency and safety of each boat, running practically side by side.

The explanation for this method of handling such a skiff soon became plain. No ordinary boat can safely run a swift and tortuous stream when floating at the same speed as the current. It must go either faster or slower, in order to respond readily to the rudder or paddle when steering. In a canoe the occupants of course face ahead, while by letting the skiff run down stern first the oarsman, and in this particular instance the steersman, also faced down the river, the full advantages of which I learned later.

Since the river was unknown to my Michigan guide, who was to manage the canoe, it was arranged that I should sit in the stern of the skiff, facing upstream, and, with the canoe keeping 50 yards or more in the rear, I could signal the character of the water at each bend and which side the canoe should take when necessary.

The first proof that the different methods were based upon the character of the boats came a few minutes after starting. On rounding a bend we found in the middle of the stream, less than 30 yards away, an immense rock, over which the water was breaking with great force and against which we would have drifted broadside, as the current divided. Tom pulled vigorously to the left, quartering upstream, and although he could not quite stem the current the boat slowly worked inshore, with a good margin to spare when we dropped past the rock. Had the boat been going

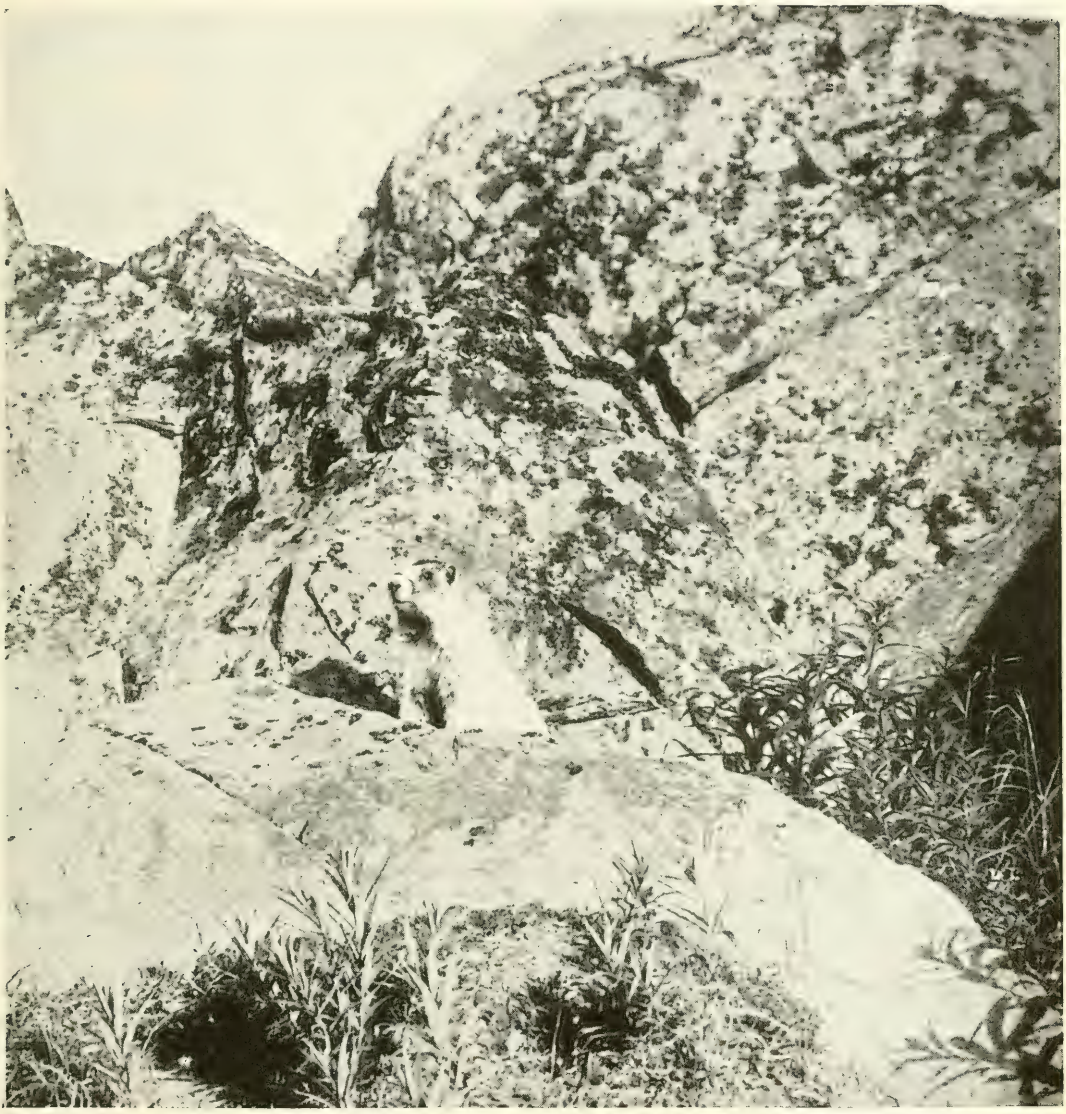


Photo by George Shiras, 3rd

ANOTHER VIEW OF THE HOARY MARMOT, RARELY FOUND BELOW TIMBER LINE

They have a remarkable system of signals on the approach of an enemy. This marmot had just signaled our approach with an almost human whistle, which was as clear as a bell. The whistle often confuses hunters who have been separated.

faster than the current, with the oarsman's back to the danger, a smash-up would have been a certainty. Charlie, on the other hand, in the light and easier-handled canoe, took the inshore channel with a few strokes of his paddle.

Thus the lighter boat depended upon speed and ease of propulsion, while the clumsy and heavily laden skiff, with Tom facing downstream, could be kept in the middle of the river or pulled to either side in time to avoid rocks or rough water.

I must concede, however, that there were times when the skiff thus handled had the advantage over the canoe, for when entering certain rapids, where the breakers extended from bank to bank, by pulling at the oars, and thus slightly checking the descent, the great curling

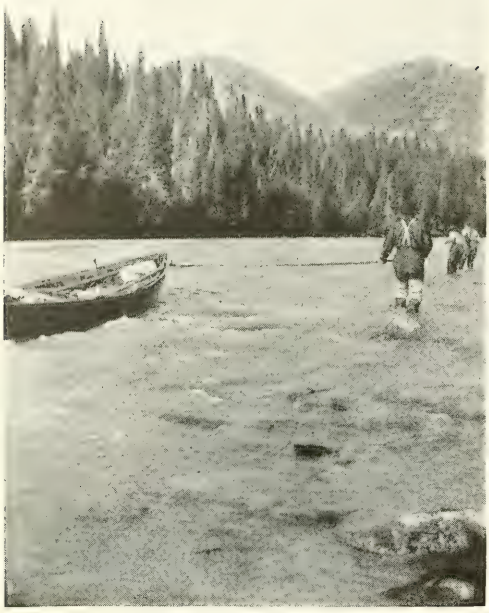


Photo by George Shiras, 3rd

TOWING OUR BOAT UP KENAI RIVER ON THE RETURN TRIP

The two men in front devote their strength to pulling on a rope, while the one in the rear, by the use of a 10-foot pole bridled to the bow, steers the craft in and out around snags and rocks in shallow water.

waves fell away harmlessly from the flat stern, because they were receding with the same speed as the current. At such times the canoe, drifting rapidly with the stream and often going much faster in order to keep its course, would be deluged with spray, and occasionally a large wave would overlap the bow.

To those who have occasion to run swift and crooked streams, where the backwoods craft is apt to be one of the easily constructed, box timbered kind, this method can be highly recommended as safe and comfortable. Were such a method in vogue on other Alaskan rivers many a miner's life would have been saved and many a valuable cargo carried safely to its destination.

At a box canyon, some three miles above the lake and where the river runs like a mill-course between high and perpendicular cliffs for nearly a quarter of a mile, we portaged over the canoe and our more valuable stuff, since I was unwilling that any risk be taken. A week before a large boat, containing government supplies, was nearly lost at this point and, half filled, floated helplessly down the stream.

When making this portage it became apparent that we had reached the first great fall and winter range of the moose, for the numerous and well-worn runways, the trees denuded of their bark and lower branches, together with an occasional shed antler, told the story.

Here we camped for the night, near one of the few sloughs connected with the river, in hopes of a moose picture or two, but the high stage of water and the fact that the most of these animals were then at the edge of the timber line or in the great swamps west of the river valley only resulted in giving the mosquitoes an unexpected but welcome meal.

Shortly after starting the next afternoon the canoe, in making a quick rush to avoid going under a log jamb, got ahead of us, and when overtaken, ten minutes later, we found Charlie clinging to a bush with one hand and bailing out with the other, having kept to the middle of the stream when rounding a sharp bend, thereby running into what the natives call "smoky water," which adventure might have been avoided had we been in advance or had he known the river better. When asked about the matter, he cheerfully remarked that it was now plain why Tom had given him all the canned goods—"because they were water-proof."

PICTURESQUE SKILAK LAKE

Finally, the boats came to the first slack water and the next turn showed the lake, higher by several feet than usual at this season, but smooth and glowing in the quiet hour preceding sunset. For the first time the oars and paddles became necessary for locomotion and, relieved from the continuous strain of watching for rocks, log jambs, rough water, and tumultuous whirl-pools, we enjoyed the placid surroundings to the utmost.

Dividing the mouth of the river was a low sandy island ablaze with a solid body

of crimson flowers, while a semi-circular shore, with a yellow ribbon of sand, was backed by a green fringe of spruce, and on either side towered snow-capped mountains, extending half way down the lake, where rounded and rolling hills sank into a great flat, extending to Cook Inlet on the west and Turnagain Arm on the north. A wide valley on the left, with a muddy floor, resembling a former river-course, and through which there trickled several small streams, Tom said was the outwash plain of a great glacier, beginning a few miles back and extending, he thought, 65 miles to the southwest, but about which little was known or at least recorded. His statement immediately aroused my interest, and during the succeeding days I learned much about the great ice field from which the Skilak glacier flowed; so that on my return to Seward, and later to Washington, I was able by dint of much inquiry to learn something further of its history, with a view of suggesting in a general way the possibilities of its origin and its probable status among the great ice fields of the northern continent.

Photo by George Shiras, 3rd

THE WORST PART OF TRACKING: REQUIRING THE MEN TO WADE IN SWIFT WATER OF UNCERTAIN DEPTH TO AVOID LOG-JAMS AND OVERHANGING TREES

Photo by George Shiras, 3rd

AN EASY HALF MILE, WHERE THE ORIGINAL FORESTS ON THE BANK WERE CUT DOWN BY RUSSIANS IN 1857

Continuing down the lake, Tom pointed out what he called a "low divide" in the southern range, saying it was the gateway to the sheep country, 10 miles or so in the interior. In the setting sun the distant patches of alders and matted forests looked like smooth greenswards on gently sloping sides and the climb appeared easy—an impression, however, which changed considerably when we came to struggle for 3,000 feet up the precipitous sides, where the feet became imprisoned in gnarled limbs and the packs were continually catching in the stiff and unbreakable branches of the dwarf hemlock.

GULLS AND CORMORANTS

On reaching the lake we had studied its general contour, and estimated the distance to our first permanent camping site to be some 10 miles to the south-

Photo by George Shiras, 3rd

BREEDING ROOKERY OF THE BLACK CORMORANT

One of two rocky islets near the eastern end of Skilak Lake, one being occupied by cormorants exclusively, and the other by gulls and terns. Note that the cormorants, on skyline or rock background, are not protected by their coloration, unlike the gulls, who are so protected (see page 441)

Photo by George Shiras, 3rd

NEST OF CORMORANTS ON A PINNACLE OF THE ISLAND: THE MAIN SHORE BEHIND SHOWS THE SNOWFIELDS CLOSE TO THE SHORE OF SKILAK LAKE

west. My desire to remain for one night at the upper end of this fine body of water was strengthened by observing two rocky islets ahead, over which gulls, terns, and cormorants were flying in considerable numbers. When passing by these, many nests were seen, and in a few minutes the boats were beached in a sheltered bay just opposite the islands.

Here, growing in the shallow waters, we collected our first wild onions and, erecting a single tent on the sandy shore in order to escape a hoard of mosquitoes buzzing in the forest behind, we spent a rather uncomfortable night, but entertained by the shrill cries of the gulls and the weird grunts and groans of the black cormorants. Shortly after sunrise the bird islands were visited, being escorted to a landing place by a great flock of protesting parents.

While the gulls and terns continued to circle just overhead, the cormorants flew a short distance on heavy wings, dropping into the lake to watch with anxiety our visit to their nursery. Some of the scenes are recorded in the accompanying pictures, with explanatory foot-notes.

THE GIANT MOOSE OF THE KENAI PENINSULA

Continuing along the high and rocky northern shore seven miles, and finding the direction of the wind favorable, though a considerable sea was running, we crossed the lake, where it was about four miles wide, to a beautiful little beach flanked by a grove of open pines, the site selected for a two weeks' camp, and situated at the end of the longest and most sheltered bay on the lake (see page 447).

The distance across the base of the western promontory was less than 75 yards, so the canoe was carried over, and during the remainder of the stay we had boats in adjoining bays, thus saving considerable time, according to the direction taken in our trips by water, besides affording a lee shore for one boat or the other, an important feature in a country where furious gales suddenly spring up in response to local conditions and seldom

Photo by George Shiras, 3rd

TWO YOUNG FEATHERLESS CORMORANTS IN NEST, ABOUT 8 DAYS OLD: THE SMOOTH AND SHINY BACKS AND THE BLUNT HEADS MAKE THEM RESEMBLE TURTLES

forecast by the barometer. For the then and future identification, we called this Double-bay camp.

The erection of the tents, the manufacture of camp furniture, and the setting up of the light sheet-iron Klondike stove took the remainder of the day.

Towards evening I ventured back into the forest to look for signs or the sight of a moose, for we were now in the home of the *Alce gigas,* and the several large runways on either side of the tents showed that we were then trespassing upon one of the main thoroughfares around the lake. But no fresh signs of any kind were found.

At dusk the guides saw, from a near-by knoll, five moose wading in the shallow waters of a pond a mile and a half distant. This sight went far to sustain the information upon which the present camp was located.

Selecting a good game country does not of itself imply individual success, though of course the main element in such. All wild animals of the larger kind have a particular range, or cover, in an extensive region, and quite often change these systematically, according to the season, or arbitrarily, according to the conditions of the weather and food supply. Therefore, before starting for Alaska, it was deemed no more important to go to a good game region than it was to go to the best part of it, for the allotted time was too limited for determining the latter by personal investigation. It is the too frequent lack of this kind of foresight which so often brings bitter disappointment to hundreds, who feel assured of success simply because of their entry into a country reputed to be swarming with game.

If my advance information were correct—and it came from several sources—it meant that I would find, to a certainty, more or less moose in an area of less than a square mile, and at a period of the year when they were hardest to locate, while the white sheep were to be

Photo by George Shiras, 3rd

HOW THE SAME TWO CORMORANTS LOOKED ONE MONTH LATER

looked for in several converging ranges, all under easy scrutiny from a single point of observation. And, in regard to the moose, this requires an explanation.

In all my journeys to the wilderness home of hoofed animals, I have only occasionally found an extensive region without animal licks, those resorts where the mineralized waters or soil attract ruminant quadrupeds. True, many of these spots are unknown, even locally; but nevertheless some hunter or explorer frequently knows of such places. And here the game photographer should locate for a while, however much a true sportsman may decry the destructive custom of killing the visiting animals at a lick, be it natural or artificial.

Some day I hope to summarize the result of an extensive investigation of hundreds of these licks, many of them thousands of miles apart, and frequented at different times by deer, caribou, elk, moose, sheep, goats, buffalo, and antelope. Just what elements attract and how each mineral affects them, physically and in their habits, presents many interesting phases (see pages 443 and 448).

It will suffice here to say that salt, soda, iron, and sulphur, in the order given, either singly or in combination, cover practically the attractive qualities of these licks. It is certainly very strange that such an interesting subject has never received any serious and comprehensive treatment by sportsmen or scientists.

An Eastern sportsman had informed me that a mile or so west of the present camp there was a good-sized lick, and, from the signs about it, he judged that a number of moose visited it, even in the summer time. As Tom had been his guide, I knew there would be no trouble finding it. However, I was told, on reaching Seattle, by a member of the party first attempting the ascent of Mt. McKinley, of a large lick less than 100 yards from the south shore of the lake, and in the same general direction as the other one. It was therefore apparent that, while neither of my informants knew of both licks, they were evidently in the same drainage basin and not more than a mile apart.

Feeling satisfied it was near the shore lick the guides had seen the five moose, and as it would be accessible by canoe and less disturbed by tramping about on

Photo by George Shiras, 3rd

ANOTHER NEST OF THREE CORMORANTS, 10 DAYS OLDER THAN THE TWO IN THE PRECEDING PICTURE

Unlike young gulls of a much younger age, they do not leave the nest when alarmed, but groan and disgorge the contents of their stomachs. The cormorants in this picture disgorged two quarts of fish from their pouches when the author appeared to photograph them.

land, I made up my mind that this would be the place where the spruce blind should be erected and my first efforts made in getting pictures.

OUR FIRST SIGHT OF THE GIANT ALASKA MOOSE

What happened the following day is described in extracts from my notebook:

"*July 24, 1911—Ther., 68-50.*

"At 9 a. m., in a bright sun and a dead calm, we started to look for the moose lick near the shore, and situated, according to directions, at the westerly base of a long point, which I took to be the one heading towards the lower end of Caribou Island. In half an hour the canoe entered the channel between the island and the point, and in a few minutes we swung around towards the bite of the bay. Tom said that the previous winter he had run 14 moose, principally bulls, off the island while crossing the ice with a dog-sled carrying provisions from Cook Inlet to a mining camp, but he did not think we would see any bulls now, as they were all hiding in the thickets well up towards the mountain-tops.

"A moment later he whispered, 'Gee! there's a bull, and a big one, too.' What I had taken for the brown soil on the roots of an overturned tree was a large moose with antlers that excited attention, but no more so than the tawny color of its coat. I had never seen such horns before nor such a color. The moose was solemnly watching the canoe, with the greater portion of the antlers shoved up into the lower branches of a spruce.

After examining him carefully through a powerful field-glass, I was about to prepare for a picture when Tom, who had been gazing about, said, 'Gee! Two more bulls! Look to the left.'

"And there, coming in file towards us, were two big brown-coated beasts with antlers that would tickle a Maine hunter, but somewhat smaller than those of the first. Sinking back into the bow of the canoe, I got the camera ready for the pair.

"But with that perversity with which providence is well supplied, the bulls turned towards the bigger one and for a moment or two rubbed noses in a friendly way—the climax of my opportunity, but missed by overcaution—when they passed to the rear and soon out of sight. They had doubtless been disturbed by us further down the shore. But the big fellow, motionless as an image, still gazed at the three heads peering over the edge of the grass."

And here it may be interpolated that no antlered animal of the earth is more obtuse and stolid than the moose, and no animal, when finally alarmed, is a greater victim of an increasing and progressive fear than this. At times it seems almost impossible to alarm them, and then, when this is accomplished, one wonders whether they ever recover from the shock.

Twenty years' association throughout their general range, with dozens of pictures by daylight and a hundred taken under the blazing, roaring flashlight—some only 20 or less feet away—make such conclusions irrevocable in the writer's case, whatever others may say regarding the supposed sagacity of the moose and the alleged skill required in accomplishing its undoing.

"Getting out of the canoe, I counted on a picture as he swung clear of the tree; and, walking slowly, got within 50 feet, when he backed a few yards and then peered under the branches from the other side. Taking a picture in this unsatisfactory position, I again advanced, when he slowly turned about and walked away with the spruce intervening.

"Somewhat disappointed, I returned to the water, and, when about stepping into the canoe, noticed the bull was coming back, and in a minute he was gazing once more through the branches of the spruce; but as it was now time for his noonday rest, and since he evidently was determined to see the thing out in a comfortable way, he unconcernedly lay down, and then for the first time I was able to see, in all their symmetry, the great horns just above the top of the high grass.

"This led to a change in my plans, and, detaching the smaller and faster lense, I got out a big telephoto for the purpose of obtaining, by a slower exposure, a picture of the great antlers. Armed in this way, I began a slight advance to where the footing would be firmer, when he got up with considerable energy, and all I could see on the focusing mirror was his slowly retreating rear—an unattractive target for the camera, however vulnerable to a ball projected by a modern rifle.

"Thus three big bulls had, in the course of ten minutes, offered easy shots to the veriest tyro, while a picture, worthless beyond its power to recall the scene, was the result of my first encounter with the giant moose.

"Pleased by the prospective and disappointed somewhat by the retrospective, a search for the lick was then begun, which I felt sure was not far away.

THE BIG MOOSE LICK OF SKILAK LAKE

"A short distance beyond the canoe, in the left-hand corner of the little bay, we found a mud-hole around which the grass had been trampled for some weeks, and the riled condition of the water showed that one or more moose had been there within a few hours. Looking beyond and through a fringe of trees, I could see a big bare field, the surface of which was plainly several feet below the surrounding marsh. Familiar with similar conditions, I felt certain that this was one of the greatest resorts of its kind I had seen in many years, for every inch of soil removed was either eaten or swallowed in the process of guzzling the mineralized water, oozing out here and there and covering a considerable part of the surface (see page 448).

"It was plain, too, on closer inspection, that the long drought had begun to affect

Photo by George Shiras, 3rd

COLONY OF GULLS ON ISLAND ADJOINING THE CORMORANTS

Here the protective coloration makes them difficult to be seen, whether on skyline or rocks. Contrast with the cormorants on page 438

Photo by George Shiras, 3rd

GULLS

As it was impossible to photograph the gulls on the foreground shown in this picture, because of their protective coloration when crouched low, the author gradually compelled them to walk to the skyline. In this respect these young gulls possess an obliterative coloration quite in contrast to the young cormorants on the adjoining island.

Photo by George Shiras, 3rd

YOUNG GULLS WHOSE LATER COLORING HARMONIZED WITH THE ROCKS AND GRAY BRUSH SO CLOSELY THAT IT REQUIRED A SKYLINE PHOTOGRAPH TO SHOW THEM

See writer's opinion on protective coloration in first part of sheep article

the surface flow, for much of the ground was hard and dry, which accounted for the moose opening up a new lick near the lake by tapping the springs at the base of the sloping shore.

"The number of fresh tracks and the variation in size finally convinced Tom that a good many bulls were regular patrons. The surrounding country had all been burnt over many years before, and this was somewhat unfavorable for daylight photography, since bull moose are largely nocturnal, unlike the caribou and elk, especially when visiting licks or exposed feeding places. The ones we had just seen were early morning visitors, and the little patch of spruce would have sheltered them until afternoon or evening but for our unexpected arrival.

"While talking over the location of the blind in reference to the position of the sun at different hours and the probably prevailing winds—the two vital elements in this kind of photography—we saw the big bull a mile away, tearing along the top of a bare ridge leading to the mountain forests. His gait showed that stolidity had at last given way to a belated but overpowering fear. We never saw that animal again in the weeks spent on the lowlands. When cutting some brush a good-sized cow moose walked up within a stone's throw, trotting away unmolested.

"Anxious to know the number and course of the runways and the character of the country immediately back of the lake before taking up the daily vigil at the blind, we went inshore half a mile to the pond where the moose were seen the evening before. Here several acres of pond lilies in shallow waters were untouched—not a leaf or root had been eaten or disturbed—in striking contrast to the moose of Maine, New Brunswick, central Canada, and Minnesota, which always considered such aquatic plants the choicest of summer food. Yet I noticed the same lack of appreciation in the moose of higher altitudes in Wyoming and elsewhere. Going a mile further, Tom recognized a high mound as the lookout for the other lick, and this was examined with great care. While used to some extent, it was only a brief stopping place for the moose en route to the shore lick—indicated by the runways, but more particularly by the condition of the soil."

Whenever the wind was favorable and the weather clear I went to the blind, but usually between 9 and 4 the breeze came from the lake, cutting off the principal runways, so that in a few days a number of moose suspected, though unjustly, that a foe was in ambush near the lick.

Altogether I saw some 30 moose in the immediate neighborhood, many of them the same animals, returning on different days. One big moose came within easy rifle shot, got the scent and retired,

Photo by George Shiras, 3rd

ARCTIC TERN ENJOYING A RIDE ON A DEAD LIMB FLOATING IN THE CENTER OF SKILAK LAKE: THE BIRDS ARE LOATH TO LEAVE WHEN PHOTOGRAPHED AT SIX FEET

and two others, equally big, were at the lick one morning on arrival, but could not be photographed from the water. All the others, with one exception, were cows or bulls ranging from one to five years of age. The exception noted was an enormous bull that came down wind on an unused runway to the rear of the blind just when I was eating lunch. He gave a loud grunt behind my back and I nearly choked with surprise. In the excitement he got away, leaving only a mental picture of a frightened moose and a flustered photographer.

I saw no calves and only their tracks in some of the heavily forested valleys about the lake. Occasionally large moose could be seen a mile or two away feeding in and out of the willows near the summit of the mountains.

The light-brown color, noticeable the first day, was repeated in the case of all the other moose, the shade approaching very closely that of the great brown bear of the inland. Judging from the shreds of the spring-shed hair and that of several abandoned hides near hunting camps, the winter pelage must be a light buff-brown in color. In the extreme southern range most moose are dark-colored in summer, looking almost black at a distance, with a somewhat lighter shading on the legs and flanks.

Some of the pelts examined show that all the hair of the narrow abdominal strip was glossy black, while that of the side and back had buff-brown tips, with a pure white body to the root, so that, with the darker tips clipped, the animal would appear to be white from the ventral strip upwards.

The present classification of the giant moose depends chiefly upon skull characters and colors of the male, as shown by Mr. G. S. Miller, Jr., in the original description of the species, but it will doubtless prove that a careful examination of the pelage colors, superficial or otherwise, as in the case of *Ovis dalli* and *Ovis stonei,* will afford even better grounds than were originally supposed for recognizing the Alaska moose as a distinct form. The greater average size of the horns should also form a distinct character.

Several encounters with regular patrons permitted observations somewhat out of the ordinary and may be quoted in part:

Photo by George Shiras, 3rd

VIEW OF SKILAK LAKE FROM OUR CAMP (SEE PAGE 439)

A COW MOOSE THAT BECAME SELF-EDUCATED

"Caribou Island Camp,
"August 17—Ther., 74-38.

"Just before noon the wind veered to the south, coming well offshore. Charlie paddled me across the bay to the blind and then went after a mess of partridges.

"I was hardly in ambush before the old cow moose was at a mud hole opposite, drinking a gallon or two of the muddy mixture. So active was the effect upon the salivary glands that long strings of saliva drooled to the ground (see also pages 443 and 448).

"Determined to try for a close picture and to test her disposition when thus interrupted, I boldly walked in view, crossing the bare and much-trampled field to within 50 feet. She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach (see page 451). Taking a picture, I went a little closer, when she turned away without looking, and again the camera recorded the scene.

"While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and to the nature faker sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly (see page 453).

"Wishing to avoid alarming her so soon, I backed across the field to the edge of the marsh, but she still followed. Turning my back to the animal, I walked ahead, and upon reaching a place where the ground was almost impassable with fallen timber, I stopped. By this time I noticed that she had crossed my tracks, and thinking perhaps I was mistaken about her wishing to get the scent I awaited developments. The cow immediately came up, circled almost within reach, and then was struck by the scent.

"The effect was instantaneous and remarkable. Sinking back on her haunches, I noticed that the shoulders trembled violently, just as though a rifle ball had penetrated her through and through, and then, with a quick awkward plunge, she made off at her fastest gait. And thus this innocent and impassive animal suddenly revealed its inherited dread of human scent."

Photo by George Shiras, 3rd

THE MOOSE LICK OF SKILAK LAKE (SEE PAGES 441 AND 443)

The impregnated soil has been eaten several feet below the surrounding marsh, exposing rocks and uncovering many small mineral springs. The view shows the lower half of the lick, looking toward and across the western end of the lake. The water brought back by the author shows the following analysis: "When the container was opened and air came in contact with the water, the clear water became, after some hours, opalescent, as if sulphur had separated out. Qualitative analysis showed in the water: sodium, strong; chlorine, strong; iron, marked; aluminum, marked; calcium, decided; magnesium, certain; sulphuric acid, present; phosphoric acid, present; sulphides, present. Quantitative analysis of clear water gave 175 grains of total solids present in one U. S. gallon of water. From the determination of chlorine and calculation of this as sodium chloride, there was found 113.9 grains of common salt to one U. S. gallon of the water. The taste of the water was strongly salt, with a bitterish after-taste. In its behavior on evaporation it resembled the saline waters of Ohio. It is positively a saline water and not an alkaline water."—Analysis by Dr. Charles E. Munroe.

A LITTLE BULL MOOSE THAT WAS FORCIBLY EDUCATED

A few days later there occurred another scene in the same locality and with a somewhat amusing sequel:

"August 27—Ther., 58-34.

"One of my favorite visitors was a little bull moose. At first he always came in company with a five-year-old, but the latter got too much scent once and ran off, with the smaller one trailing wonderingly behind. On this occasion he was alone. The way he kept eyeing the blind rather indicated that a visit had been made there during my absence.

"Today he came from the long point, where the flies were scarce, and after filling up nearly to the bursting point, laid down in the middle of the lick for a nap. As this was to be the next to my last day in the blind, I concluded to try some more experiments. Coming out of the blind, he saw me at once, but did not get up—simply turning his ears my way and expressing great astonishment in his big, round eyes.

"When I got very close he arose and walked to the edge of the marsh, when, getting the sun behind me, I took his picture (see pages 455-458). And later I tried to force him down toward the lake in order to get a more effective background. This he objected to, but ran about playfully, showing no concern whatever over the scent.

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore.

"Selecting a good-sized club, I got as close as possible, partly accomplished by grunting like a bull.

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and one end flying up hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs—however much it violated the ethics of striking below the belt—for he jumped up into the air with his back arched like a scared cat. When he came down there was no doubt about his intention or ability to get out of that part of the country. Before I could pick up the camera he had vaulted over and beyond the fallen timber."

Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose.

The following day I came to the blind at an early hour, hopeful that one of the big bulls from the hills would come within photographic range. Just what occurred becomes a necessary part of the diary entry of the previous day.

"August 28—Ther., 72-38.

. . . "From the start the wind was variable and so light that the mosquitoes became annoying for the first time. Twice I saw a cow moose wandering about, but she was wary. As the hours passed I was satisfied that the little bull had made his valedictory appearance and was not disappointed by the thought.

"Precisely at 2 I heard the sound of a heavy animal running, then a splash down toward the lake, where I could see the little bull struggling out of a mud hole, his feet working like the blades of a water-wheel, and then out he got, rushing on without a stop or a glance to the rear. Evidently something was after him—possibly a grizzly bear that looked now almost as big as a locomotive.

"Getting out the field glass I covered what was likely his back track for a long distance, finally noticing the figures of two men coming down a hillside, and as each was armed with a rifle I knew they were not my guides. On their approach I arose, and after a greeting found that the larger and heavier of the two was Jim Jeffries, the ex-heavyweight champion of the world. He explained in substance that they were out after a supply of fresh and tender meat, preparatory to hunting big bulls for their heads: that

they had seen in a dense cover the flanks of a small moose, and to make sure it was not a cow, the killing of which was prohibited by law, they crept up very close, when, making a slight noise to bring the head in view, the animal gave a quick glance out of the corner of one eye and then put down the hill as though the devil was after him. Not till he was beyond favorable rifle shot did the glass disclose the small horns. They were now pursuing it in hopes of a shot. The man of muscle trusted that they had not interfered with my getting a photograph of the little bull. Assuming a slight disappointment, I indicated that it was fully overcome by the opportunity thus presented of getting a photograph of a *homo gigas* and snapped him instanter."

That this latter picture does not appear herewith is due to the conservative attitude of the Editor, who "was uncertain whether some of the readers of this Magazine would stand for that kind of wild game." Hence the omission.

A month later I heard that the little bull had apparently gone through the hunting season unscathed. This year he is proudly growing a pair of Y-shaped horns, and who knows but what in the course of time he will be seen stalking across the ruddy tundra or standing like a sentinel on a granite ridge wearing a polished and serrated crown, so remarkable in size and symmetry that the *Alce gigas* of the Kenai shall have in him that type which will represent in the future as in the past the largest of the antlered race since the days of the prehistoric Irish elk.

A NEW SPORT FOR OLD SPORTSMEN: HUNTING FOR SHED ANTLERS

When a sportsman visits the distant wilderness and shoots a big bull elk, moose, or caribou, especially in the rutting season, when they are most easily found and killed, it is seldom that any of the rank flesh is used at all, and the horns afford the only trophy, while the great carcass, weighing from 400 to 1,200 pounds, according to the species, is left for the ravens and the coyotes to feed upon. And even though such big beasts are killed at a time when the meat is untainted, its toughness or the great distance from civilization prevents much of it being used.

On one of my photographic hunting trips to Newfoundland, I met, far in the interior, three Eastern sportsmen who had just killed nine big caribou stags, the three apiece allowed by law. Only the heads were removed, for the 3,500 pounds of meat was then unfit for food. As fully 100 non-resident sportsmen were there on the island, the abandoned carcasses might better be estimated in tons than pounds. With the smaller varieties of deer, killed usually in the neighborhood of settlements and generally free from a seasonal taint, such wastefulness seldom occurs.

To a sportsman controlled by the most ordinary sense of propriety, it must necessarily follow that after getting a fine head or two of the larger game, he ought then to discontinue their pursuit with a deadly weapon. To one who uses from the start, or later supplants the rifle with the camera, there exists every corresponding incentive in this more harmless method and a much better opportunity of studying the life of wild animals.

Yet it is easy to see how there may be those who desire, in addition to pictures or lantern slides, some more tangible evidence of their visit to the remote homes of our antlered monarchs, and this is to suggest a way of getting such trophies without shedding blood or wasting mountains of flesh.

Between November 1 and March 1 the larger bull caribou, moose, and elk shed their horns, and in the order given. Unlike the white-tail deer, which usually drop their antlers each fall in the dense coniferous forests and swamps, where porcupines, rabbits, red squirrels, and mice soon destroy or disfigure the same, the caribou, when feeding in the winter time on the moss of the wind-swept barrens, the elk upon the dry grass in the open parks and rolling hillsides, and the more northerly moose upon the bark in the willow thickets or second-growth hardwood forests, usually cast their antlers in places harboring few if any form

Photo by George Shiras, 3rd

THE LARGE COW MOOSE THAT EDUCATED HERSELF (SEE PAGE 447)

She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach

of rodent life, and hence in such localities one may find many horns and most of them in perfect condition.

Such as have become bleached from long exposure can be stained to their natural color, and, when mounted on a wooden base the fac-simile of a frontal bone, resemble in all respects those of a freshly killed animal. While it has long been the custom in this country to mount the head and neck, in time the shrinking skin, the twisted ears, and the ravages of the moths greatly impair the work of the ordinary taxidermist, so that the old English method of simply using the horns and part of the skull has much to recommend it; for such ancient specimens after untold centuries are often superior to those in this country after a lapse of a few years.

Of course, in the mounting of shed antlers, only the largest and most symmetrical should be used, in contrast to the habit of mounting many inferior heads; but a great deal of pleasure can be had and much information obtained by collecting in the wilderness all sizes and shapes of horns, and it is immaterial that in many cases only a single antler can be found.

During explorations covering three seasons in the Rocky Mountains, I discovered along the upper Yellowstone River, partly in the park and partly in Wyoming, a very large number of moose occupying a valley four miles wide and thirty miles long, at an elevation of 8,000 feet, where, isolated in the wildest and least frequented portion of the country, they had thrived unknown to the public. My notes and photographs, covering observations of more than 500 moose and in a country where they were then supposed to be practically extinct, was most

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE COW MOOSE THAT EDUCATED HERSELF

"I went a little closer, when she turned toward me, and again the camera recorded the scene"
(see page 447)

impressively corroborated by the fine collection of moose horns, found along the river bottom in willow thickets, where the absence of pine forests and the annual overflow each contributed to the scarcity of rodent life. These horns were later presented to the Biological Survey and constitute its only collection of the mountain type of this animal.

During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the poplar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation.

By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside

Photo by George Shiras, 3rd

THE SAME COW MOOSE COMING TOWARD THE AUTHOR

"While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and, to the nature-faker, sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly" (see page 447).

from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed (see pages 460-461).

The members of two hunting parties who visited our camp were surprised and pleased at this collection, and could not understand why they had only seen a few worthless horns in their long journeys afoot. This was because the more open country was usually watched from a knoll with the aid of field-glasses, or they failed, when moving about, to detect the prong or two of some great horn nearly hidden in the soft moss, or did not know the meaning of the great white slabs here and there on many an exposed hillside. In one case I located the best antler of the trip at the distance of over a mile, the glass showing that the serrated edges could not be other than the outer rim of a fine horn.

Three distinct types of horns were found: First, the so-called normal, or broadly palmated kind; second, one of great length and narrow beam, and third, a small fan-shaped variety (see picture, page 465).

The first type was represented at times by two rather unusual modifications: (*a*) great thickness of the lower beams with a second set of brow antlers beneath, and (*b*) broadly palmated horns with no divisional separation of the so-called brow antlers (see page 464).

In no other range of the moose have I found such a variety except in the highest mountain valleys of the Rockies, and it suggests the conclusion that the northern latitudes affect and vary the

horn growth as do the higher altitudes further south.

The writer earnestly contends that it is a false pride which always leads a sportsman to pass by a beautiful antler and a false standard which always requires their removal from the head of a personally slaughtered animal. To the public, for the use of museums and in the comparison and differentiation of the various types of horns, shed antlers are just as valuable and just as interesting as many having a narrative of blood and wastefulness in their taking.

Photographing wild animals requires all the skill and endurance demanded by the most ardent and experienced sportsman, and the finding of the discarded antlers of a giant moose adds a zest to the photographic hunt and a valuable trophy for the trip, and surely not less sportsmanlike because its former owner is still permitted to roam the wilderness as the largest antlered animal of modern times.

Fortunately for this branch of sport, it requires patience, persistence, a fair knowledge of the animal's habits and range, and when the best horns only are selected the collection will represent quite as much skill and value as when secured by killing the unfortunate owner thereof.

THE ALASKA PTARMIGAN AND HOW CLEVERLY THEY PROTECT THEIR YOUNG

To the mountain climber of the northland there are no birds more interesting than the ptarmigan. One species, the willow grouse, or willow ptarmigan, occupies the thickets bordering the tree limits, and a hardier and more humbly plumed kind, the rock ptarmigan, lives on the rocky slopes and snow-clad summits of the higher ranges. This interest is largely due to the ease of observation, for the birds are tame and numerous, and again because they can be counted upon to supply the larder with a portable and well-flavored article of food.

For several weeks we were in the midst of these birds, and when making daily rounds to the grassy plateaux, where the sheep were apt to be found, I spent a good deal of time following up the smaller streams in order to study and photograph the birds in their natural surroundings.

Familiar with many other species of grouse, I was particularly impressed by one characteristic of the cock willow ptarmigan, which differed so from the conduct of male grouse of the forest and prairie, in that he almost invariably remained with or accompanied the female during the entire breeding season and, moreover, was the most aggressive parent of the two in times of peril.

One's proximity to the family was usually foretold by the sudden fluttering out of the cock, which, with a limp and trailing wing, employed the usual devices of most ground-breeding birds in the effort to coax in futile pursuit any known or suspected enemy, and then, if successful in leading such away from the spot where the young crouched by the side of their silent mother, the cock would take wing, uttering loud and raucous notes, finding concealment in a near-by thicket.

But if one persisted in trying to locate the young, then the female would renew the effort to distract attention, and if this did not succeed she would utter a peculiar note signaling the male to return, and then between the two of them some plan would be devised to prevent the discovery or injury of the young birds.

In a hundred or more observations the cock was apparently absent only half dozen times, which might be accounted for by his untimely death in defense of his family or by a temporary absence in search of a particular kind of food.

Two instances of this strategic cooperation of the parents may be quoted from my notebook:

"August 9.

"Following the creek bottom for nearly a mile, we found the ptarmigan unusually abundant, for the day was warm and quiet and the birds were sunning themselves on the gravel bars or dusting their feathers in basins hollowed out in the sloping banks. One brilliantly colored cock rushed out at us from a patch of dried grass and I followed him down the stream a few rods with the

Photo by George Shiras, 3rd

THE YOUNG BULL MOOSE THAT WAS FORCIBLY EDUCATED (SEE PAGES 449-450)

camera, but his gait increased until he took wing, so I returned to the spot where the rest of the family were doubtless concealed and could faintly see the hen outlined in the thin grass, while the five or six young, almost at my feet, were not noticed until the old bird took flight, when they, too, popped up into the air, and with their short wings managed to fly out of the creek bottom and tumble into a willow thicket a few yards away.

"Going to the lower end I had one of the guides walk through the willows, but before the family were driven out the cock returned in response to the call of the hen, and I finally got a picture of him standing boldly on a rock in the middle of the stream. The parents then led the young into a blue bed of flowering peas, and when the two returned to guard the retreat I got a portrait of the pair" (see pictures, page 466).

Again, under date of August 27:

"While sitting in the spruce blind waiting for moose, I noticed a large hawk circling the marsh in search of prey. As it passed behind me there was a roar of wings, and turning I saw a brood of willow grouse in the air with the hawk poised above, apparently uncertain which victim to swoop down upon, but before this was determined the cock shot up straight as an arrow in front of the hawk and then the race was on. For the first 50 yards the two were separated by only a few feet, but the way the cock suddenly increased its speed showed very plainly that flight was under check until the hawk was lured away far enough to give the surprised family a chance to find some sort of concealment.

"In a minute or so the hawk returned and carefully circled over the hummocks of moss, looking intently for the slightest trace of one of the covey. Down it suddenly dropped for a distance of 20 feet—undoubtedly seeing the brown feathers of a partly concealed bird—but with equal speed the hen darted up, apparently hitting the body of the hawk just below the tail, and either because the talons could not clutch it in such a position or because unable to strike with

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE YOUNG BULL MOOSE WHO WAS FORCIBLY EDUCATED (SEE PAGES 449 AND 450)

accuracy, the daring mother escaped with the hawk in fierce pursuit. Here, again, the slow speed enticed the hawk some 50 yards away, when the hen dropped like a plummet into a bunch of alders, while the hawk seated himself on a near-by limb to plan anew his breakfast.

"But the defeated aviator knew very well that two from eight left a substantial balance, however deficient the mathematical process, and once more he returned for a survey of the tangled moss. This time he was met by a shout and a waiving hat from the spruce blind, and, much disgruntled, soared away, doubtless wondering at the intervention of a third party, a wonderment that would have been still greater had it known the deadly relation between man and every bird and every animal possessing toothsome qualities, or whose plumes, pelage, or antlers had a monetary or trophy value."

In such efforts to save the young it was clear that the parent birds possessed the same bravery and the same cunning methods in misleading an aërial enemy that they did a terrestrial one.

In the Kenai Peninsula the timber line is about 2,000 feet, and only twice were willow ptarmigan noticed below it, where they were feeding in an open glade upon the earlier growth of swamp huckleberries. The usual abodes of this bird are the tablelands along upland streams terminating in ravines, where the willows and small bushes succeed the limit of arboreal growth. The rock ptarmigan either stays at the very crest of the mountains or on the sloping sides, where the lichens and patches of grass denote the limit of all vegetation. On the other hand the spruce partridge remains well within the forested area and is usually to be found in river bottoms or in the second-growth, burnt-over portions of the lowlands (see pages 467 and 469).

Thus these three species of Northern grouse, while occupying adjoining ground, are largely if not wholly controlled by the distribution of plant life rather than that of any given altitude.

One afternoon I saw a small and apparently young red fox coming rapidly

Photo by George Shiras, 3rd

THE SAME BULL MOOSE

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore" (see page 449).

down a rock slide, evidently trailing but not seeing his quarry. With a field-glass I could make out a brood of rock ptarmigan scurrying ahead. When the birds reached the bank of a small ravine, filled nearly to the surface with snow, the hen flew up about ten feet, alighting on the snow, and the little ones with an effort did likewise; and, thus concealed from the immediate vision of the fox, they ran a short distance and squatted, resembling very much the detached rocks and soil dotting the edges of the snow.

When the fox reached the bank he looked intently about and, seeing nothing, descended, sniffing along the surface of the snow below where the birds alighted. Evidently thinking that they had flown across or gone further down, he climbed up the opposite bank. Here a large fat marmot, extracting a root only a short distance away, attracted his attention, and although they were about the same size, the sudden flight of the latter induced pursuit, which ended unsuccessfully a few yards away, at the opening of the burrow.

So little time was spent on the mountain summits that I had small chance to observe the habits of the rock ptarmigan. In no case did the cock accompany the brood, and it seemed as though these birds had no fear whatever of the larger forms of animal life. The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice.

Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call. Hawks and foxes are the principal enemies, while moose, caribou, sheep, or man seem to be regarded in the light of friends.

THE ALASKA SALMON AND THE TRAGEDY OF THE SPAWNING GROUNDS

Many know that the salmon industry

Photo by George Shiras, 3rd

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and, one end flying up, hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs, however much it violated the ethics of striking below the belt, for he jumped up into the air with his back arched like a scared cat. Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose" (see page 449).

of Alaska is one of its best and certainly its most reliable producer of wealth, but few in the eastern portion of our country realize that, unlike the Atlantic species, the salmon of the northwest coast, male and female, always die following the spawning season in the fresh waters of the interior.

Of course this means that the salmon, of which there are five species, spawn but once, on reaching maturity, and therefore their perpetuation depends upon a reasonable protection for the brooding fish.

From the middle of July into October the swift rivers are carrying towards the sea millions of dead and dying fish. As practically all of these lodge on sandbars or sink to the bottom of the ice-chilled streams, the air becomes polluted and the waters defiled to such a degree that a good many who witness these repulsive scenes acquire an unconquerable distaste for salmon thereafter, be they fresh or

Photo by George Shiras, 3rd

A FAIR-SIZED BULL AT EDGE OF LICK

Note the long, remarkable "bell," which dangled for 18 inches from its neck and looked exactly like a broken halter end, swinging freely as the animal walked

canned. This should excite no prejudice elsewhere, since all the fish for commercial purposes are taken before or shortly after entering the fresh-water rivers, when they are in fine condition.

Comment has been made upon the mutilated bodies of the stranded fish, and many seem to think that this was entirely due to battling upstream amid jagged rocks, whirlpools, and rapids. The writer saw no indication of this, but did find there existed a strange and fierce enmity between the fish, under conditions now described, which surpassed any contest between kindred species that he had ever witnessed.

This impulse to seek the uppermost waters of a particular stream, be it a mile or a thousand miles in length, apparently continues after the spawning period, and so each salmon, weakened from spawning and the refusal or inability to eat on leaving salt water, still instinctively struggles against the swift waters, gradually drifting back, tail first, until a pool behind a log-jamb, the entrance to a slough, or the slower waters of a side channel afford a temporary

Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: SOME OF THE FINEST MOOSE HORNS FOUND DURING THE TEN DAYS AT DOUBLE-BAY CAMP, THE COLLECTION BEING ADDED TO LATER (SEE PAGES 450-454)

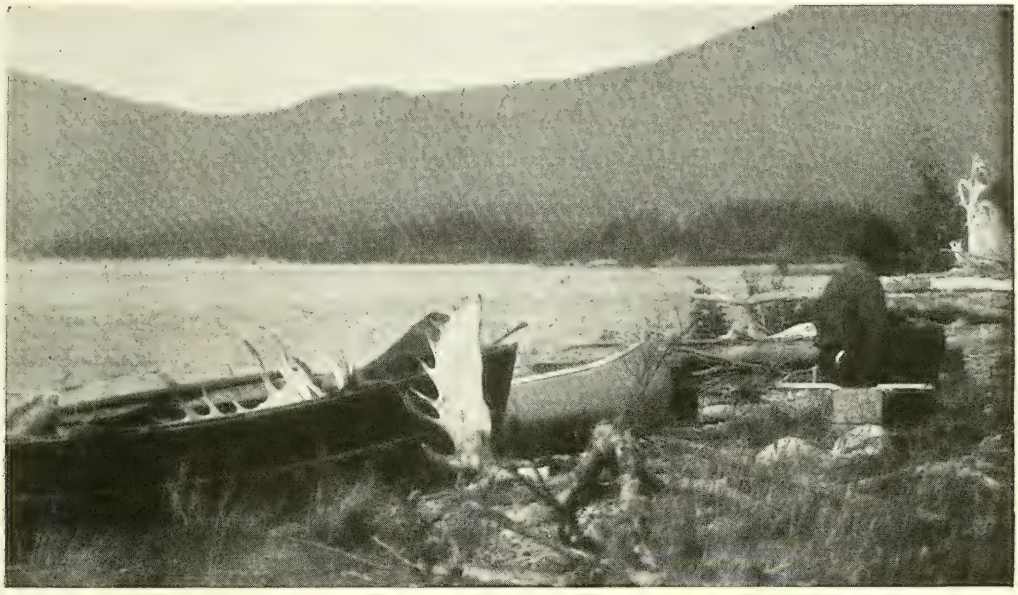


Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: A BOAT LOAD OF ANTLERS GATHERED ON THE OPEN MARSHES ON A SINGLE AFTERNOON (SEE PAGES 450-454)

harbor, and here they collect by hundreds before making another effort to ascend the stream, only to be carried further down each time, until the death paroxysm seizes each, when, after a few mad dashes with the head out of water gasping for air, they die with surprising suddenness.

The salmon most abundant in the interior streams of northwestern Alaska is the sockeye, or red salmon.

Investigations by the Bureau of Fisheries have shown that "this species is peculiar in that it rarely or never ascends a stream that has not one or more lakes at its headwaters, and the spawning grounds are usually in small streams tributary to such lakes or rarely in the lakes themselves." The average weight is about seven pounds, varying according to sex or condition. While dead, king salmon were occasionally seen floating down the Kenai River, some of which must have weighed 60 pounds, the kind coming under the writer's particular observation, were the red salmon, the most graceful and active of the western salmon.

When these fish first come from the sea they are plump and vigorous and their silvery forms often gleam high above the surface of the waters in the slow advance to the spawning ground. Gradually the colors change to a light pink and then by degrees to a deep, blood red, splotched with yellow, when they resemble gigantic gold fish. At a later period the body becomes gaunt, the head narrow and dark green, exhibiting gleaming rows of shark-like teeth, and then this once beautiful salmon of the high seas becomes reptilian in form and disposition.

It was in the quiet, shallow pools of the inside channels of the upper Kenai River, between long islands and the shore, where the milky glacial silt was precipitated to the bottom and the waters became clarified that the writer was able to observe and study for a number of days the action of the imprisoned fish.

One hardly realizes in traveling on or along a glacial stream how beclouded are such waters. At the junction of the Kenai and Russian rivers this becomes strikingly apparent, where the latter, fed by the springs from the lower hills, is unusually clear, even though hundreds of dead salmon covered its bottom when we saw it. The photograph on page 470 gives a fairly good idea of this contrast.

Between August 29 and September 3

Photo by George Shiras, 3rd

A SPLENDID PAIR OF ANTLERS, WITH THE SKULL ATTACHED: FOUND ON THE BANKS OF THE UPPER KENAI RIVER

It is impossible to tell whether the animal died of old age or from wounds. Spread, 5½ feet. Note extraordinary brow antlers, which have a spread almost equal to the main branches (see page 453).

the gradually falling river had in many cases separated these pools by intervening bars, so that the fish, varying from two to a dozen, could be watched and the individual relations of each easily determined. While it was at once seen that the salmon were carrying on a continual warfare, it was not until the close of the first day that I found that the fish were paired apparently by hate and not by any ties of affection.

Whether this was a sexual antipathy I could not then determine, although as a rule only one fish was the aggressor, the other spending its time trying to elude the attack. Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim.

On the four days spent returning up the river, and while the men toiled at the tracking line, I walked slowly along the banks, carrying a pack containing the more valuable part of our outfit, and so there was plenty of time to observe the salmon. From my notebook the following extracts depict what was happening much of the day:

"In one pool, separated by shallow water from the others, there were ten salmon and all in a state of fierce con-

Photo by George Shiras, 3rd

YELLOW-HAIRED OR NORTHWESTERN PORCUPINE, WHICH HAD COME TO GNAW ONE OF OUR SHED ANTLERS

It became necessary finally to suspend these horns on wires from trees to escape porcupine and squirrels. "During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the poplar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation. By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed."

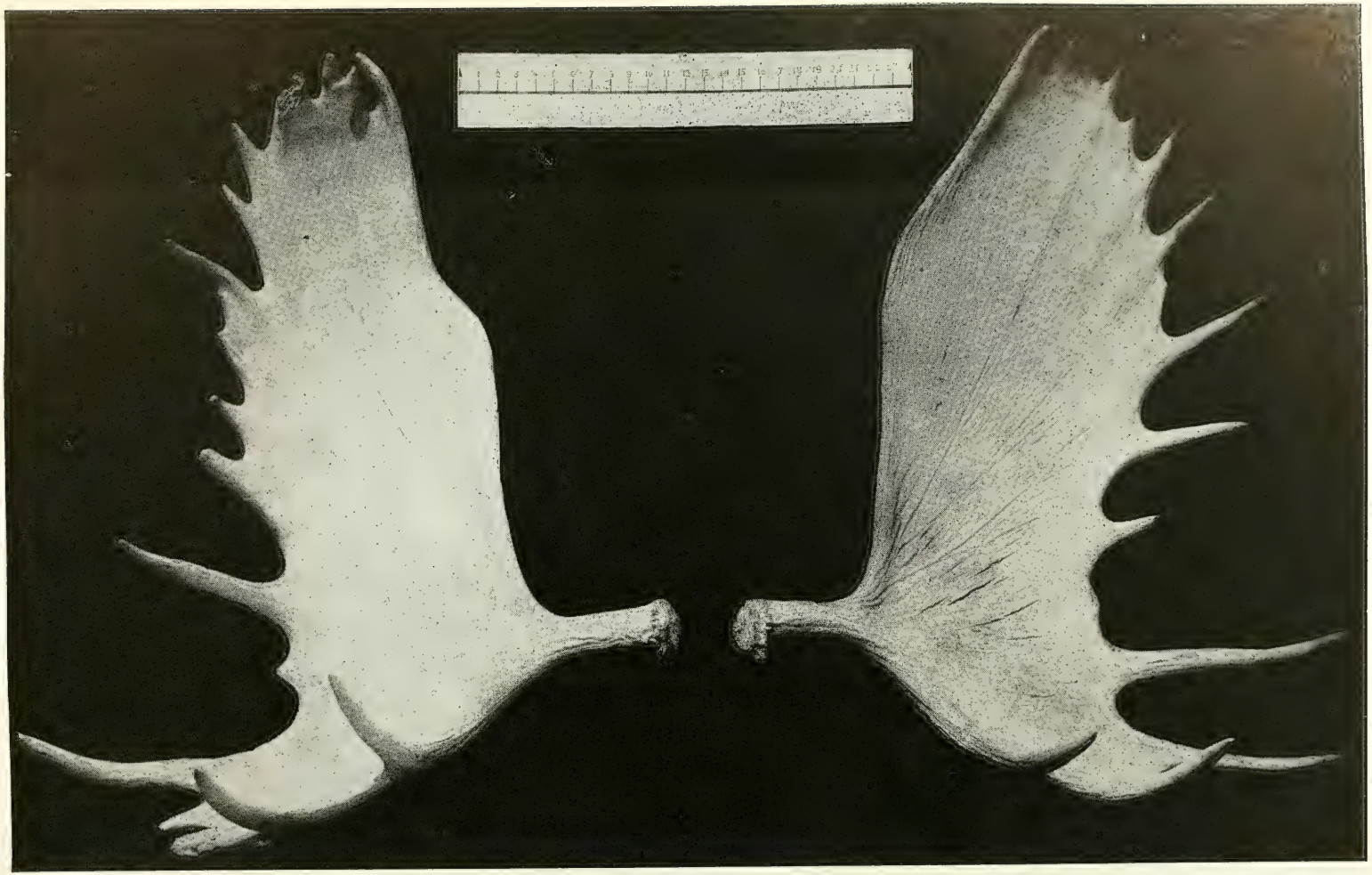


Photo by George Shiras, 3rd

A VERY LARGE PAIR OF SYMMETRICAL HORNS AND NOTICEABLE FOR THE ABSENCE OF ANY DIVISIONAL SEPARATION OF THE BROW ANTLERS, THE PALMATION BEING CONTINUOUS IN EACH ANTLER

Contrast these with the large and distinctive brow antlers shown on page 462. The spread of these antlers doubtless exceeded six feet. A two-foot scale is shown at top of picture

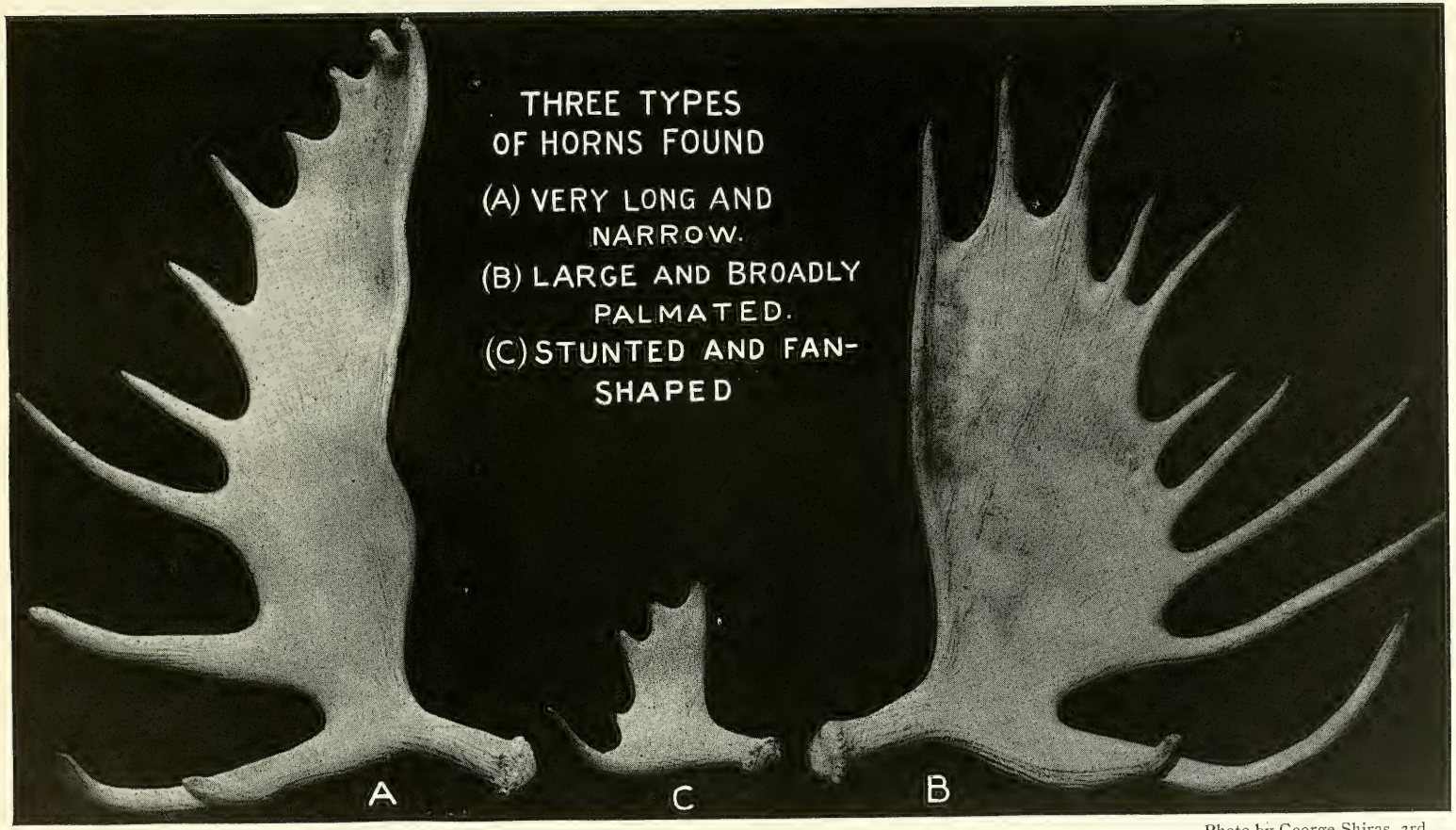


Photo by George Shiras, 3rd

THESE HORNS REPRESENT THREE DIVERGENT TYPES OF ANTLERS FOUND DURING OUR EXPEDITION: PHOTOGRAPHIC SCALE IS THE SAME AS IN THE PRECEDING PICTURE (SEE PAGE 453)

MALE OF WILLOW PTARMIGAN ON ROCK IN ROARING STREAM

Photos by George Shiras, 3rd

PARENT BIRDS OF WILLOW PTARMIGAN GUARDING RETREAT OF THEIR YOUNG

The birds show remarkable cunning in enticing enemies away from their young. For the story of these pictures see pages 454 and 455

tention. Two of these pairs were so uniformly persistent in their movements that I noted the same carefully.

"In one case the attacking fish would drive its unresisting companion half out of the water on the lower bar by biting vigorously at the tail, and then leaving it stranded in the scorching sun would return to the upper end of the pool until the other fish, after slowly wriggling its body around, would re-enter the pool, when the attack would be renewed in precisely the same manner. This continued during two hours' observa-

Photo by George Shiras, 3rd

FEMALE OF WILLOW PTARMIGAN STANDING ERECT, AND WITH THE YOUNG STANDING IN INSTINCTIVE IMITATION

Photo by George Shiras, 3rd

FEMALE OF SPRUCE PARTRIDGE

A MOUNTED GROUP OF WILLOW AND ROCK PTARMIGAN, SHOWING THE WINTER (WHITE) AND SUMMER (DARK) PLUMAGE, WITH THE INTERMEDIATE

FEMALE AND THREE YOUNG OF THE ROCK PTARMIGAN

The subdued and grayish-brown plumage make a photograph of the four birds difficult without a background of white

Photos by George Shiras, 3rd

FEMALE ROCK PTARMIGAN, PHOTOGRAPHED AT FIVE FEET

"The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice. Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call" (see pages 456, 457).

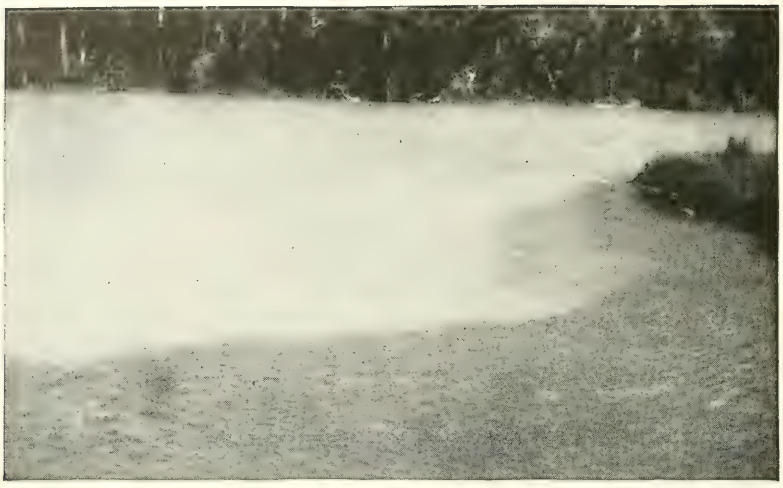


Photo by George Shiras, 3rd

JUNCTION OF THE KENAI AND RUSSIAN RIVERS, SHOWING THE MILKY, GLACIAL WATERS OF THE FORMER COMMINGLING WITH THE CLEAR, SPRING-FED WATERS OF THE OTHER (SEE PAGE 461)

tion, and in that time the victim of this relentless pursuit was driven on the bar about one hundred times.

"In the second case the pair swam side by side in a circle and seemed amicable enough until the inner salmon gradually crowded the other on to a shoal, when it would drop back and seize the tail of its helpless mate and, after rending it for a moment or so, the two would begin circling again.

"The remaining salmon in the pool were carrying on contests more or less similar. In no case did they interfere with another fish except when it got in the way or tried to occupy a position reserved by the others."

The possible explanation for this strange conduct—and the subsequent suggestions come largely from those better informed upon the habits of these fish than the writer—is this: (1) That the imprisoned fish had not yet spawned (corroborated by the fact that I saw no dead or dying ones in these pools); (2) that the female, restrained by the instinct from depositing her eggs except in small streams tributary to lakes, refused to spawn, even though the period was about over; and (3), that the male fish, mated from the time of leaving the sea, had not only become infuriated at the conduct of the female, but likewise angered by confinement, was venting his rage upon a mate in no wise responsible for the situation—a trait not always confined to the male of the fish tribe.

I found it difficult, if not impossible, to get satisfactory photographs of these battles, for the lens loses its power to penetrate the water whenever the surface is broken or ruffled from any cause. The pictures accompanying the text illustrate this, where a slowly moving salmon is plainly to be seen below the surface; while where the two pair were fighting, only the portion out of water is visible (see picture, page 471).

In the main channel of the river and its tributaries, where there was plenty of water for the fish to move about freely, I saw only an occasional fight, possibly near the spawning beds, and the nervous energy of certain fish seemed directed against the swift current, with which they struggled desperately until repeated inhalations of air above the surface produced a delirium and death apparently by drowning; and that this was confined to those which had already spawned now seems likely. At tidewater, where swift and short mountain streams often bore many of the weaker fish into the bays, I saw one salmon tear to pieces seaweed, and in the final dash its teeth locked on an upturned strand of vegetation and thus it died. The next day I could see it, head down and tail up, swinging in

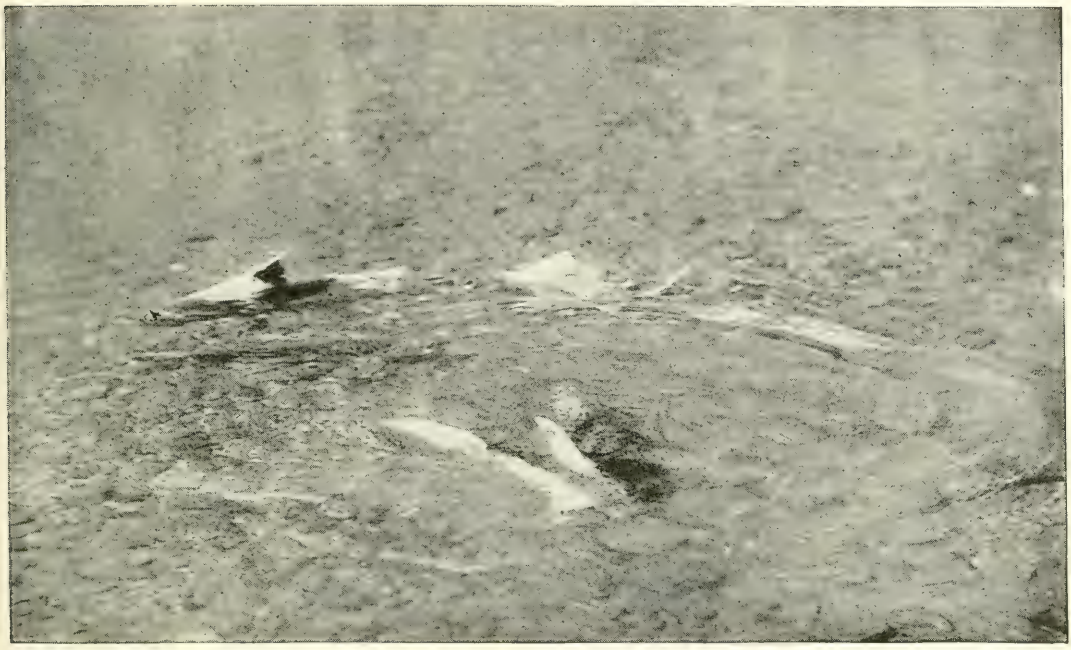


Photo by George Shiras, 3rd

SALMON FIGHTING IN KENAI RIVER

In the upper pair the rear fish is rending the tail of the other; in the lower couple the fish to the right has just bitten a piece out of the dorsal fin of the other (see page 462). "Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim. In one pool, separated by shallow water from the others, there were ten salmon, and all in a state of fierce contention."

Photo by George Shiras, 3rd

THE IMPRISONED SALMON OF THE UPPER KENAI

A gaunt and fierce male, the under portion of the body deep red and that above the surface of the water a dirty and festering yellow (see pages 457-466)

the tide. Thus even the brine of the ocean had no restorative effect.

In such bays, owing to the higher temperature and the greater buoyancy of the salt water, the dead and dying salmon usually floated on the surface, and it was a gruesome sight to see hundreds of gulls, poised on wing, awaiting the moment when they could alight safely upon the body of a fish and pluck out both its eyes, as it rolled over and over in the final struggle.

That death should be the penalty of parentage for all the salmon of the Pacific is generally regarded as one of nature's mysteries, and deepened by the safe return of the North Atlantic salmon to the sea.

But in this number of this Magazine appears an article by one of the leading fish experts of the country, Dr. Hugh M. Smith, Deputy Commissioner U. S. Bureau of Fisheries, and therein is explained why the salmon of adjoining oceans meet a different fate in the rivers of the North.

THE WHITE SHEEP OF KENAI PENINSULA

Before taking up the narrative of the happenings in the sheep country, it may be well to state the plans arranged in advance.

On examining game pictures from Alaska, I was struck by the scarcity of those representing the white sheep, either singly or in flocks. As hundreds of the most experienced sportsmen from nearly all countries, had pursued these animals, I had considerable doubt of success, even though having a marked advantage in a better equipment and in making my main object what in the case of the others was largely incidental.

Therefore I decided to locate and study the animals first, with the purpose of securing information about their habits and then, if possible, making use of the knowledge thus acquired to get within photographic range. Otherwise it might happen that were I to immediately begin harassing the sheep with the camera at close range I would get neither pictures nor information.

Ten days were spent in the mountains, four of which were entirely used in going and coming; and, while the six days devoted to sheep, and incidentally to ptarmigan, resulted in a fair collection of pictures, the results, I think, fully justified the procedure laid out in advance and mentioned now specifically with the view of aiding those who, in days to come, may wish to visit the scene of these brief but strenuous efforts.

Several days before starting for the interior, my old Michigan guide, John Hammer, joined us. His long-continued trips into the wilderness, and in this instance reinforced by his Norwegian blood, made the call of the North irresistible. The addition of a third man, just as we were about to undertake the hardest part of the journey, proved fortunate, and greater still when the swift waters of the Kenai River had to be overcome on our return to Seward.

At 6 o'clock on the morning of August 5 we were ready to leave Double-bay camp for a ten days' trip to the sheep country; and, with Tom and John in the heavy skiff and Charlie and the author in the canoe, the start was made for the southeast corner of the lake, just opposite the bird islands. The weather was bright and the barometer still predicted a continuation of the fine weather, so exceptional in weeks past.

On rounding the point we saw, in the morning light, the black and frowning features of volcanic Redoubt, and, a little further seaward, Iliamna's snowy peaks, 100 miles distant and on the other side of Cook Inlet. Our immediate destination, Cottonwood Creek, was reached in less than two hours, where, after placing our surplus outfit on a porcupine and bear-proof platform, made by Tom the previous season, a start was made up the mountain creek. This stream originates in a big snow field just beyond the divide, over which we had to pass on the way to Benjamin Creek, the location of Tom's cabin, where he lived during a long and vain search for gold. Though no valuable metals were found, the locality is memorialized on the map by calling the creek Benjamin, the Christian name of his eldest brother.

The ascent was a hard one, for the day was hot, the underbrush a nuisance, and

A TYPICAL HEAD OF WHITE RAM

In 1884 E. W. Nelson first described a pure white species of mountain sheep inhabiting Alaska and northwestern Canada, naming it *Ovis dalli*, in honor of Prof. Wm. H. Dall, the well-known scientist and Alaskan explorer. While the horns of this species are not as massive as those of the Rocky Mountain Big Horn, or the base circumference equal to that of the Big Horns or to those of the southern California species, the extensive spread and graceful symmetry, in connection with the beauty of the head, makes it the most-prized trophy of its race.

the packs heavy. Gradually I shed all extra clothing and then lightened my pack, the guides good-naturedly picking up the discards as they fell by the wayside. At noon the tree-limit was reached, half a mile this side of the divide, and there on a rounded knoll, with plenty of stunted hemlock for firewood, a small tent was erected for me to spend the night in, while the three men returned to the lake to bring up another load in the morning (see picture, page 474).

On their departure I lay on a cushion of moss and for many hours swung the field-glass, now into the valleys, then upon the foothills and peaks, then down upon Skilak Lake and across the great untrodden tundra, with its many glistening ponds—the summer nursery of the moose. Most interesting of all this limitless scenery was Cook Inlet, looking like a giant river and banked on the western side by the mountains of the Alaska Range, the great cordillera of the Territory, with Mount McKinley as the keystone in the semicircular swing of this great upheaval.

But later my interest became centered

Photo by George Shiras, 3rd

ENTRANCE TO THE SHEEP COUNTRY: LOW DIVIDE 3,000 FEET ABOVE SKILAK LAKE, WHERE THE AUTHOR CAMPED ALONE THE FIRST NIGHT (SEE PAGE 473)

in the animals and birds which, in the shadows of the declining sun, came out of thickets of evergreen and willow. At one time I could see a dozen porcupine—black-haired and of the Canadian species—feeding stolidly as sloths on the fresh vegetation bordering the receding snowbanks.

A cock spruce partridge came within five feet of the tent, evidently mistaking it for snow; a brood of willow ptarmigan were seen in the willows just above, while higher up a fox brought to view a covey of rock ptarmigan, heretofore described (see page 457). Moose signs were plentiful, but no moose were seen. The air about resounded with clear notes of the hoary marmot, the mountain woodchuck of the North (see pages 434, 435). Then came the mosquitoes, the post-season crop of the higher altitudes, when the insect-proof tent became a place of refuge for the night.

On the following morning I had hardly finished breakfast when along came the men, red-faced and tired in the fight against gravity and the worst of mountain trails. An hour later we were climbing over the broken rocks littering the floor of the divide, and thence entering a great plateau sloping southerly to Benjamin Creek. For the rest of the day we struggled through bushes, stumbling into grass-covered cracks, leaping from tussock to tussock, and circling about swamps and mud-holes.

In the midst of all this turmoil Tom pointed out round dots of white on a distant ridge which looked like weathered boulders or snowballs from the frozen fields above. These were the white mountain sheep of which we were in search.

When I asked Tom, somewhat hopefully, whether it would not be wise to begin the camera hunt at once, since it made no difference whether we frightened these sheep or not, he politely concealed a negative answer by saying that if I would circle two miles to the left, ascend the mountain top from the rear, he would drive the sheep toward me before dark. This didn't seem like getting to Benjamin Creek on schedule time; but as Tom assured me, in a sympathetic tone, that I would see four or five sheep

Photo by George Shiras, 3rd

THE MOUNTAIN SLOPES OF THE SHEEP COUNTRY

"Big Pond camp" in the foreground, situated midway between the cabin on Benjamin Creek on the west and the great ice cap on the east. The author camped alone here several nights while photographing the white sheep. Two Alaska bear visited the tent one night (see page 477).

near his cabin to one here, the march was continued, and at six in the evening the cabin came suddenly in sight, 200 feet below a terrace bordering the valley of the creek. John and I were quite used up, the former still suffering from the after-results of typhoid fever, contracted on our trip the previous year to Mexico, and I on general principles.

But soon the restorative effect of a hearty meal and the inspiration of the surroundings gave me sufficient energy to climb a hill behind the cabin, and there, at 8 p. m., I could see, at the headwaters of Benjamin Creek, three different bands of sheep, all preparing to spend the night on little open benches not much above the meadows. Such a sight told the story of a country seldom visited by man and where these aboriginal pastoral flocks felt secure by night and day.

BIG POND CAMP

At 8 o'clock the next morning we were ready to start after sheep, leaving John in charge of the commissary department. Following the creek east half a mile, we then went up over a series of sloping meadows for a distance of three miles.

A little above the cabin three small streams come together and, in combination, form Benjamin Creek. One flows in a zigzag course from the snow fields just this side of the low divide above Skilak Lake, where the melting snow is likewise the source of Cottonwood Creek; another carries the overflow waters of a big pond, in the highest meadow to the east, and the third drains several large valleys in the southeast.

The two latter streams, lying between the highest and steepest mountains in the neighborhood, cut deeply into upland

Photo by George Shiras, 3rd

TYPICAL VIEW OF SHEEP ON HIGH SLOPES BORDERING THE SNOW FIELDS, WHERE CONSIDERABLE FRESH VEGETATION IS FOUND FOR A SHORT PERIOD ON SPOTS RECENTLY COVERED WITH SNOW

The writer is not a believer in the theory of protective coloration when applying to the larger animals of this country, whatever may have been the effect of laws of nature regulating survival in prehistoric times, when the pelage colors first became constant and characteristic. Some of the smaller animals and certain birds, fish, reptiles, and insects, whose enemies are largely the same today as in the past, are undoubtedly preserved by obliterative or deceptive colors, as well as by concealing shapes. Confirming the first conclusion are the white sheep of Alaska, conspicuous for miles, and which never through apparent design sought the protection of adjoining snowbanks, however great their anxiety to escape detection or pursuit. Keenness of vision, or occupancy of a favorable lookout, and wonderful antitude in inferring

meadows, which harbored not only the band of sheep I had seen the night before, but many others.

On the way up the valley we came to the last timber, consisting of spruce, mountain ash, and a considerable number of cottonwood trees, intermixed with willows and alders. At this terminus of the forest growth there were many moose trails and numerous fresh beds made by these animals in patches of grass between the willows. It was plain that the head of this high valley and the smaller ones containing willows were the summer resorts of the bull moose. Only two shed antlers were found in our extensive wanderings, one many years old, confirming my view that all the moose at such elevations returned to the shores of the lake and adjoining lowlands during the late fall and midwinter months.

On the few occasions that Tom had hunted sheep here he had always returned to the cabin at night; but, as this meant a waste of time and energy, it was deemed best for my purpose to erect a tent in the midst of the sheep range, so that I could have a chance to watch them almost continuously during the 18 hours of daylight.

An hour after starting we came to the pond, which seemed to be the best and most convenient location, commanding as it did three of the best sheep valleys, and yet not too close to interrupt the movement of sheep from one district to another.

The tent was placed on a little knoll, close to a fine spring, and where a great black mountain rising from the opposite shore of the pond afforded a striking background (see picture, page 475). Numerous adjoining knolls covered with glacial rocks were the homes of many marmots, who viewed my canvas home with surprise and protestation (see pages 434, 435).

After lunch we made a reconnaissance, locating an unusually large flock of sheep up a valley to the north which drained into the pond, and there we spent the remainder of the afternoon, with the sheep brought within easy inspection by the use of a powerful field-glass.

The wind was blowing straight up the valley toward the flock, but there was no indication that any of the sheep suspected our presence. Not only before coming north, but later, I knew of the conflicting views held by sportsmen and guides in reference to the alleged inability of sheep to detect the near-by presence of man through scent, and it was one of my purposes to make every possible experiment in this direction.

Late in the afternoon Tom and Charlie returned to the cabin, leaving me to spend the night in the tent. Before dark I watched scattered bands of sheep leave the meadows for the higher slopes, where gradually they gathered into several good-sized bunches.

At 9:30, when distant objects became obscure, I went into the tent, and while slipping into the sleeping-bag I happened to look out the wire ventilator in the rear canvas wall, noticing two large animals coming down a ridge a hundred yards back of the tent.

My first impression was that they were sheep, or possibly caribou, but when one rose on its hind legs and looked about, I could only conclude that a pair of the big brown bear of Alaska had come to the meadow for the purpose of digging out marmots or ground squirrels.

These animals have a bad reputation among miners and explorers, due I think to their immense size and their near relationship to the grizzly, around which many of the blood-curdling tales of this country have been woven. Based upon my own experience and the carefully sifted experience of others, I had long ago come to the conclusion that there are no dangerous wild animals whatever in the northern hemisphere, except the grizzly, and this only occasionally when molested.

Having no intention of interfering with these visitors, I felt little concern, although quite appreciating that it might be a dearly paid experience if I neglected taking such precautions as were then possible. So the little automatic revolver was placed by my side, the opening of the tent closed, and, when too dark to see anything further, I crawled into the canvas sleeping-bag. Once there seemed to be something sniffing behind the tent,

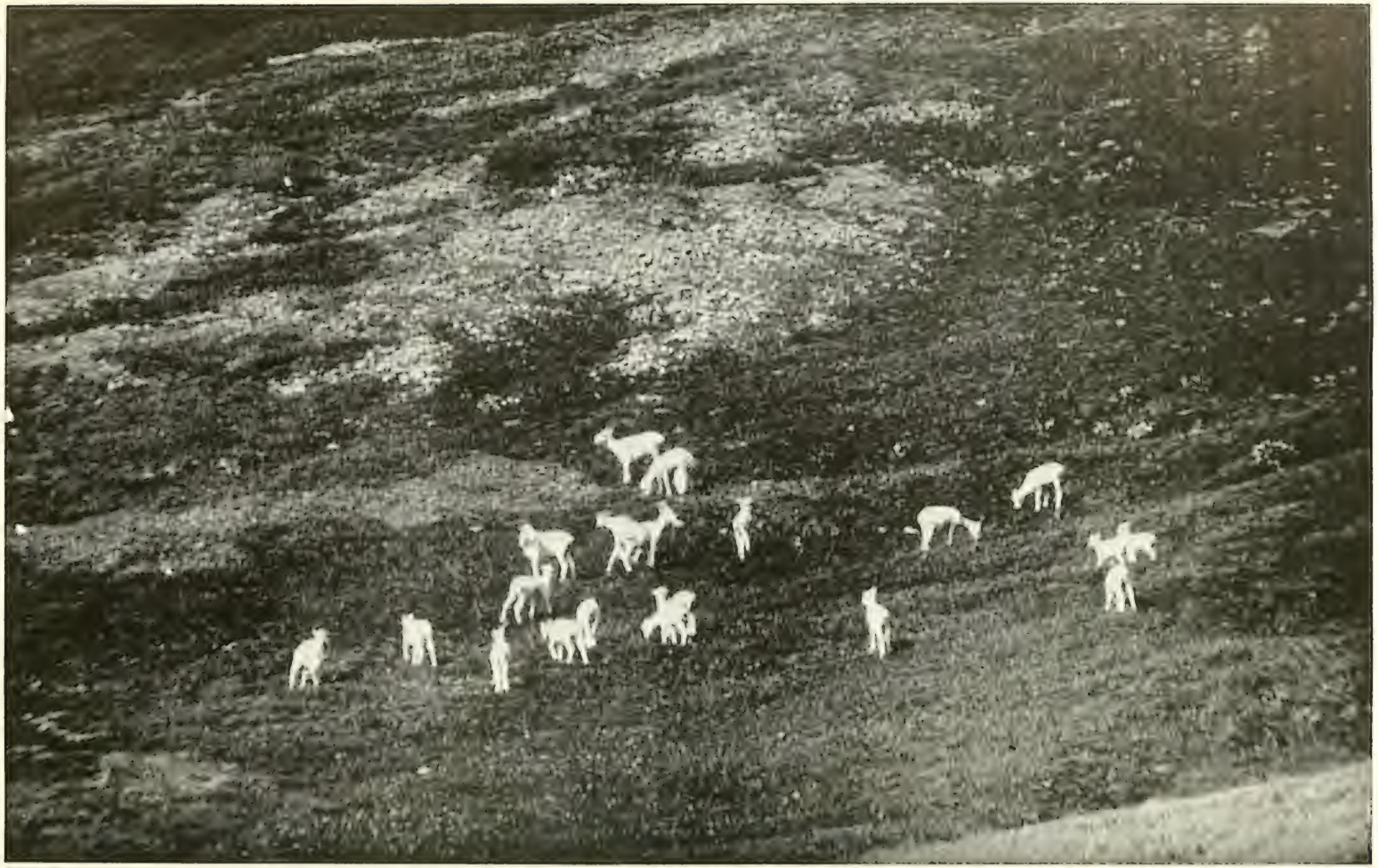


Photo by George Shiras, 3rd

THIS REPRESENTS A SMALL BAND OF SHEEP THAT HAS JUST COME FROM THE MOUNTAIN TOP TO A LOW MEADOW COVERED WITH FRESH GRASS AND SMALL PLANTS: SEVERAL LAMBS ARE PLAYFULLY JUMPING OVER THEIR MOTHERS (SEE PAGE 479)

but there was no way of determining the question without going outside. Gradually my nerves quieted down and the next thing I knew was the buzzing of the mosquitoes in the morning, brought into activity by the early rising sun.

Several hours later Tom arrived with cooked food sufficient for three meals, and, after sampling some of this, we returned again to the valley where the sheep were seen the afternoon before. The big band had broken up again into small flocks and were feeding on the same meadows, some of them working down our way. The wind still continued to blow up the valley, but as I now wished to get some views of the sheep grazing here and there on the meadows and at the same time determine with preciseness just how close one could get before the scent created alarm, we cautiously approached.

MANY FLOCKS OF SNOW-WHITE SHEEP

When 400 yards away from the nearest flock, a little blind was made by cutting out brush in the edge of a thicket on the top of a mound, and there we went into concealment for a number of hours. All the sheep were gradually working down wind, and the prospects for pictures and of determining their scenting power became excellent.

The nearest flock, when 300 yards away, began showing some uneasiness. The old ewe in front, and which had charge of this particular flock, several times raised her head, sniffing the air suspiciously. At 200 yards the leading ewe stopped, looked directly our way, and I felt sure the limit of the approach had been reached, so several pictures were taken of the band.

And none too soon, for the leader then turned back, and in a stiff-legged and peculiar way strode through the flock, with her little lamb following obediently in the rear.

All the other sheep, some of which were grazing and some lying down, seemed to take immediate notice of what was going on, for when the old ewe reached the end of the flock and began ascending the steep slope instead of continuing up the valley meadow, the rest fell in behind and in a few minutes a great long file was zigzagging up the side of the mountain.

And here occurred another striking result. Four large rams that had been reclining on the top of a flat rock 200 yards beyond the rest of the sheep all stood up and began looking about, first at the line of sheep ascending the mountain and then down the valley. Whether their restlessness was wholly due to the flock of sheep leaving the valley at that hour or to the manner or peculiar actions of the ewe or whether they had gotten a trace of scent was hard to tell.

Soon the other sheep began working away from us, finally dropping into a meadow walled in by a stone ridge running across the head of the valley except where broken by a narrow opening, through which a little stream dashed in a series of cascades.

During this and all successive days we saw none of the sheep drink water either from the streams along which they grazed or from any of the pools of water in the green meadows. Whenever the sheep became thirsty they always went to a snow field, and so noticeable was this that I spent a part of one day getting into a position where photographs could be taken of sheep coming to the snow banks for that purpose (see pages 484 and 487).

A little later I saw a band of about 20 sheep coming down the side of a distant mountain toward the meadow and on the dead run, jumping rocks, slipping and sliding down the steep sides of the bare mountain, hurrying across little terraces, over which they leaped and continued their rapid and downward course.

So striking was this sight and so certain was I that these sheep were badly alarmed that I aroused Tom, who was dozing in the sun a few feet away, and pointed to the sheep. Looking at them for a moment he said, "Why, those fellows are just coming to the meadow for their afternoon meal, and seeing all the others at work are losing no time in doing it."

"Just watch them," he continued, "and you will see that on reaching the bottom of the hill they will begin butting one

another and cutting up all kinds of capers" (see picture, page 478).

And that is exactly what happened, for on coming to the edge of the little creek butting matches began, while some of the lambs jumped entirely over their mothers. At the creek it was a pretty sight to see them leap from bank to midstream, where rocks amid swirling waters gave a footing, and thence again to the opposite shore.

But the bunch of sheep which had come down the mountain in such haste either saw or smelled me when I photographed them, and immediately departed by the same route they had come. Also every sheep in the meadow behind the stone ridge left immediately for the mountain top.

I was curious now to know just how this little meadow looked, so we walked up and crossed over the top, looking down into a beautiful spot. Below was a circular meadow, containing a small but beautifully clear pond, and the trampled condition showed that every day the sheep came there for grass, which was unusually green and abundant. Whether at one corner of the pond a good-sized mud hole indicated the presence of a lick I could not tell at the time and was sorry not to have investigated it later.

This seemed an ideal place for close-range pictures, so we immediately began the construction of a blind on the face of the cliff, looking down upon the meadow. A narrow ledge allowed the piling up of flat stones until there was room for three of us to squeeze in behind and point the camera downward. We then left, but returned the following day. The experiences of our day in the blind are given in the following extracts from my notebook:

A MORNING IN THE SHEEP-BLIND

"August 12—Ther., 75-52.

"Today was selected for a visit to the stone blind above the little basin meadow, regardless of wind or weather. The three of us had spent a rather uncomfortable night in the small tent, and at an early hour I heard the men breaking the stunted willows for a fire and a cup of hot coffee. But the fog for the first time had descended into the valley and no object could be seen more than 50 yards away. This resulted in a later start and in the end proved a mistake.

"When half a mile below the blind, the fog lifted suddenly and the warm, bright sunlight illuminated the valley and the mountain sides in a way to accentuate the heretofore restricted vision of man or beast.

"Above us on the left, near the summit of the mountain, was a band of about 40 ewes and lambs, all lying down, but evidently looking at us. Two hundred yards above the blind, and on the same side as the others, were two big rams a little distance apart. One was watching us most intently, and in a moment began the ascent, while the other, apparently alarmed at his companion going up instead of down at the feeding hour, began to scan the bottom, where he soon saw us, though standing motionless. Instead of retreating he walked to the edge of a cliff and, standing like a marble image, gazed in our direction.

"Soon our positions became irksome and we started for the blind, while the ram immediately trailed after his more cautious companion and disappeared over the mountain top. Had we arrived an hour sooner none of these sheep would have been disturbed and, in addition to getting their pictures in the little meadow, probably others would have been attracted from more distant points. Entering the blind, everything was soon ready for an instant or continuous bombardment. But an hour passed and nothing came down any of the many runways, radiating like gray ribbons from the green meadow.

"Finally Tom, who thought that the big flock of ewes was past due, climbed cautiously to the top of the cliff behind the blind, and on his return said that not a single sheep was in sight. Among this flock were many that had seen us slipping up the valley, besides having additional warning in the hasty departure of the rams. This inferential power of sheep is remarkable.

"The 'sure thing' counted upon, like most predetermined results, had missed a cog somewhere, and when noon ap-

Photo by George Shiras, 3rd

A LARGE BAND OF SHEEP, NEAR THE MOUNTAIN TOP, CROSSING A SNOW FIELD FOR THE PURPOSE OF CLIMBING THE ADJOINING CLIFFS FOR THE NIGHT

proached the principal object of interest was the lunch-box. Finally, four sheep were seen on the skyline two miles away, and down they started on one of the big runways leading to the valley. They came rapidly and were soon standing on a bare plateau a quarter of a mile above the meadow. Here they stopped and looked below, but in a few minutes began grazing on the sparse grass. After remaining half an hour they took a trail toward the head of the valley, where there were doubtless a good many other sheep.

"It was then that the idea suggested itself of a light and portable set of life-sized profile decoys, made of white cloth, which could be set at any angle and where they could be seen broadside at a long distance. The day before, as al-

Photo by George Shiras, 3rd

A HIGH MEADOW STILL COVERED WITH MUCH SNOW: THE TWO EWES ON THE LEFT ARE HAVING A DISAGREEMENT OVER FOUR OR FIVE LAMBS THAT ARE PLAYING TOGETHER

ready stated, we noticed how quickly and unsuspiciously small and scattered bands of sheep descended and joined flocks already feeding in the valley.

HOW THE BIG RAM WAS PHOTOGRAPHED

"At noon the lunch-box was opened, but before we had fairly made a start I saw a big ram approaching along a ridge from the direction of our camp. He came rapidly, with head up and mincing steps, looking very much like a small and sturdy caribou stag. When in sight of the meadow he stopped and looked down for fully five minutes, occasionally scanning the mountains on our side.

"We feared that, like the others, he would turn away at the sight of the deserted meadow. Tom, however, thought that the ram was most anxious to join a band of his fellows and might cross to our side in order to look for such beyond. At any rate he soon started down toward the creek and we were in doubt as to his final destination. At the edge of the bank he disappeared, and we then felt sure he would come along our ridge, but on which side was the question.

"Several moments passed, and I feared he was then passing behind the blind, cut off by a wall of rock against which our backs were resting. Slipping the strap over my neck, which supported the heavy camera, I was just in the act of climbing over the top of the blind when Tom seized my arm, whispering: 'Good Lord, here he comes right at us.'

"And there, stalking along most unconcernedly, was the ram, not 40 yards away, and, if not interrupted, would soon be gazing down into the blind.

"The several portholes made for the camera all faced the meadow, for an invasion from any other quarter had not been looked for. When he got within 75 feet I was in a quandary. To rise up nearly full length above the low wall of the blind meant his instant alarm, with no time to obtain the sharp focus necessary with such a big lens.

"Holding my fire, I trusted to fate. At 50 feet he stopped, turned broadside, and nibbled at a sprig of vegetation. Silently and quickly, in one steady motion, I arose, with my eyes fixed on the focusing mirror instead of looking at the ram directly. On the ground glass I saw his head raised suddenly and turned my way. Quickly the milled head of the focusing screw brought him in focus and the focal-plane shutter clanged harshly.

"But his white form had vanished when I raised my head, and, to Tom's and Charlie's inquiring glances, I could only say that the effort was successful, provided the ram was not in air when the shutter revolved."

It was two days before I went to Tom's cabin, and when darkness begrudgingly came at 10 p. m. I dropped the negative into the developer and in a few minutes saw on the plate the big ram, broadside, head up, gazing at the camera (see page 492).

PECULIARITIES OF THE SHEEP

The next and final day at the head of Benjamin Creek was reserved for studying and photographing a large flock of sheep, heretofore occupying the end of a ridge west of our tent and which always fed on a large circular meadow, nearly surrounded by small canyons.

At no time did the daily program vary. By 7 o'clock the entire flock of about 50 descended the mountain, crossed a little creek, and then in bunches of six to a dozen scattered out over the meadow, feeding not only on grass, but small bushes. Quite often some of these bands, containing many lambs, would work their way out to the edge of the meadow, fully three-quarters of a mile from the base of the mountains, so that their retreat could readily be cut off by the intervention of a man with a rifle or by any fleet-footed predaceous animal. This, of course, meant an entire absence of molestation during the season and probably for years.

In the daily movement of the sheep on the steeper mountains I noticed that in coming down they usually took an earth trail, however loose the soil or treacherous the shaly rocks. On their return the steepest cliffs, if affording a good foothold, were ascended in preference to the near-by trails used on their descent.

The probable reasons, if my brief observations warrant an opinion, were

Photo by George Shiras, 3rd

SHEEP THAT HAVE SPENT THE ENTIRE AFTERNOON ON A MEADOW WELL SUPPLIED WITH WATER, WHICH THEY REFUSED TO DRINK, NOW QUENCHING THEIR THIRST ON SNOW

these: (*a*) On the descent the loose soil and tumbling rocks accelerated instead of retarded the progress of these sure-footed animals, while returning such conditions had the opposite effect, and (*b*) in the jumping down from ledge to ledge of animals weighing from 100 to 250 pounds, a slip or the breaking of the ledge was much more likely than when ascending a cliff, because each upward jump was made with the lightness and accuracy of a bird.

I had noticed, moreover, that at noon some of the sheep often returned for a rest on a lower slope of the ridge. There was no way of making a blind on the meadow without alarming them all, except during the night, and this would have been a difficult undertaking, so I planned getting on the ridge during the morning and after all the sheep had gone to the meadow, when there would be a chance for pictures in case any returned at noon and, with a greater certainty, as they assembled toward night in the vicinity of the blind.

After breaking camp in the morning, Charlie continued on down the valley with his pack to the cabin, while Tom and I left ours near the pond, where we intended wading the outlet stream, so as to reach the base of the ridge at a point where nothing could see us from the meadow. This stream proved much deeper and swifter than it looked at a distance. While not objecting to a wetting, we feared being carried off our feet, with the resultant injury or loss of the photographic outfit. It is in just such cases that a rifle will stand much more ill-usage than a camera. Nearly an hour was spent gathering and throwing flat stones into the swift water until a secure footing was obtained.

On reaching the edge of the ridge, at a point about 200 feet above the meadow, we could see many scattered bands of sheep; but, to our disappointment, a dozen sheep were now coming along in single file toward the ridge, and were then too close for us to pass around and get in a position to meet them on their ascent, so there was nothing to do but to await developments.

In a few minutes they had jumped the creek, one lamb falling over backward into the water, much to the indignation of its mother, who stamped her feet vigorously as her bedraggled offspring endeavored to climb the steep bank. With a single and later exception, this was the only time any sheep, big or little, proved awkward or careless.

PHOTOGRAPHING THE SENTINEL EWE

When the band finally came up the slope they were soon lost to sight and we waited until they had time to reach a resting place. On climbing to the rim I saw the flock about 200 yards to the left and on the same level. All were lying down but one, evidently the sentinel.

After carefully studying the approach and figuring on the possibilities of remaining concealed, Tom assured me "that with ordinary crawling agility one could get within 50 feet." But as Tom could crawl like a serpent, climb like a squirrel, and had the equipoise and jumping ability of an ibex, his encouragement was of a doubtful character.

Experience had taught me, however, that while it was important not to be seen approaching, it was equally important, when armed with a camera, to know the exact position of the animals in relation to the last cover sought.

Having determined this I started on all fours, a mode of travel rendered more difficult by being compelled to push the heavy camera ahead. When the final rock was reached, I very slowly pushed a piece of small brush to the top of the rock and then raising my head looked through it. This method, if observed by animals near at hand, might excite a puzzled interest, but even so is safer than the appearance of a human head a few yards away.

The sheep were lying in a row, less than 20 yards off, and the sentinel ewe was standing, with a little lamb at her feet, while to the right was a large ewe lying down and the rest near by. I could see that it was impossible for the plate to cover them all and be in proper focus. Then came the idea of getting the sentinel ewe and lamb, thus supplementing the picture of the big ram and completing the family group. In a moment the

camera was arranged and at a focus probably requiring no further change when brought to bear upon the sheep.

Lowering my eyes into the hood surrounding the focusing mirror, I slowly arose, and when the camera cleared the top of the rock I found the sentinel looking directly at me and in sharp focus; so, without a moment's hesitation, the button was pressed and the shutter revolved. What the camera saw is now reproduced on page 490.

Before the frightened sheep had a chance to gather their wits I had reversed the plate-holder and caught the band as they struggled in a disordered way over the broken rocks above me (see photograph, page 491).

We then set about constructing a comfortable blind between rocks concealing us from animals coming from below or above, and where we could remain the rest of the day watching the scattered bands of sheep on the meadow below. It seemed that practically every such band had a leader, and in moving from one locality to another or when feeding, one could readily pick it out. And this, today, is the surviving and predominating characteristic of domestic sheep. A dread, growing out of their exposed position and distance from the mountain, was noticeable, too, and manifested by the way the sentinel sheep continuously surveyed the country (see page 489).

And here there may be interposed some general observations on the above subject. Mr. Charles Sheldon, who is accepted, and properly so, as the leading authority on northern sheep, inclines strongly to the belief that such bands of sheep have no sentinel in a strict sense, but rather that the more alert or experienced of the members at times give the appearance of prearrangement for guard duty. Such a conclusion is undoubtedly true of caribou and elk, but in the case of sheep, where gregarious ties are very strong, it seems to me that the assumption or selection of a leader, covering days and perhaps seasons, means the necessary assumption of lookout duties, unless such a leader is thoroughly satisfied that every condition is favorable to the security of the flock (see pictures, pages 489, 490).

During my observations Tom was devoting himself to watching the mountains above, where he finally discovered a ewe coming down towards us, and which he thought was one of the sheep that might not have seen us clearly when the stampede took place and was anxious now to join the other sheep feeding in the meadows. Its course would bring it some 20 yards to the left and well out of way of the quartering wind blowing up the side of the mountain.

At 75 feet the sheep turned to the right, and, as we knew that the wind would bring it across the line of our scent, I was most anxious to note the results, even if I lost the picture. When between two rocks, with only the head and shoulders showing, the scent struck it suddenly. The animal winced as if shot and dashed upward again with the speed of a deer.

This showed pretty conclusively that a sheep at close range had a good nose, at least when previously alarmed.

Finally the animals on the meadow turned toward us, and we thought that the time had now come for a series of pictures, as band after band came up our side of the hill.

The leader of the first flock began watching the side of the mountain, coming 10 or 15 feet and then stopping for a minute or two, during which intervals the rest of the band continued to graze and often laid down. On reaching the creek the leader had apparently become very suspicious for some reason, and stood eyeing the entire side of the mountain, but finally lay down with the others, but with head turned toward the mountain side. Unquestionably the absence of sheep where they were accustomed to gather in the afternoon, and possibly the ascent of the first flock, had something to do with the uncertainty of the leader.

Meanwhile another band had come within 50 yards of the others, also led by a ewe, which acted very much like the first. In a few minutes the two bunches commingled, and, to our regret, soon began retreating towards the meadow, where they stood in an uncertain kind of way for a long time. Then the two bands separated, one continuing up the little creek. The manner of the leader, look-

Photo by George Shiras, 3rd

THE SAME BAND OF SHEEP AS SHOWN IN THE PRECEDING PICTURE, STILL EATING SNOW: PHOTOGRAPHED IN THEIR OWN SHADOWS, THEY APPEAR UNUSUALLY CONSPICUOUS ON THE SNOW

ing steadily at a distant point on the side of the mountain, led me to turn the glass in that direction, where I saw four sheep on the edge of a cliff, and towards which the band was evidently going. Soon the others were on the move across the meadows, all headed, with the exception of one distant flock, for the same spot, and we saw our chances fading away. In a short time these flocks had joined the four at the other end of the ridge, a portion doubtless of the flock which we had previously photographed, and which had sought out a new place for the night.

At 4 o'clock the little band of sheep that had been fading at the extreme western end of the meadow came trotting back on a well-defined trail bordering a canyon, and I felt almost certain that none of these sheep would come to our blind, although on five previous days all the sheep had gathered every afternoon just above it. Now, more than ever, I was convinced that a set of sheep decoys, as suggested previously, would have brought most of these sheep within photographing range. Tom even thought that a white linen night-shirt would have answered if he could have been permitted to trot about in it in front of the blind.

As the last flock continued to approach it seemed best to slip down the side of the slope as close to the creek as possible and try for a picture as they went by. When a third of the way down I found they were coming more rapidly than expected, and, in an effort to pass an exposed place between two rocks—and which should have been done by crawling very slowly—I carelessly jumped across, and in landing behind the sheltering rock I heard Tom's warning whistle.

Looking down on the meadow, I saw that all the sheep had reversed ends and were rushing back again. Since these animals were more than a quarter of a mile

Photo by George Shiras, 3rd

SHEEP TRAVELING TOWARD THE LARGEST SNOW FIELD IN THE VICINITY

Note the four big rams on the upper edge, and how inconspicuous when compared with the smaller sheep on the dark soil. The curved and bulky horns of the four rams can be clearly seen. The rams spend most of the summer on the extreme mountain tops, rarely accompanying the ewes at this season.

Photo by George Shiras, 3rd

THESE SHEEP FED FOR HOURS WITHOUT LOOKING ABOUT, EXCEPT THE SENTINEL ABOVE, ON THE LEFT (SEE PAGE 486)

The keen vision of these sheep is practically their sole reliance for detecting danger. They always feed or rest on open ridges or hillsides devoid of bushes, from which they can have an unhampered view in every direction. They also possess unusual power of inference, detecting danger from the actions of other sheep, however distant the latter may be.

away, it was a good illustration of their acuteness of sight and their quickness in realizing the character of the danger. Not knowing how these sheep could escape in the direction they were going, I called to Tom for advice. He yelled that they were now headed for an ice-bridge across the canyon (which I did not know of), and, after crossing this, he thought they would swing around our way again for the purpose of ascending the mountain slope just behind, and that if I hurried there would be a chance for a picture.

But after exercising all the energy at my command the sheep won, and I could see them 200 yards below quartering up the mountain. In a few minutes they reached a ledge of rock within a hundred feet of the crest of the great black cliff opposite the site of our former camp.

This was our last view of the white mountain sheep until two days later, when we entered the pass of the low divide above Skilak Lake.

Our visit had made the sheep considerably wilder, and the flocks which formerly rested each night on the lower benches now whitened the ledges of many a high cliff; but no red had dyed the white and woolly sides and no flock noticed an absent one within its ranks.

The next morning we left for Skilak Lake, camping a half mile this side of the low divide and giving the men a chance to make a second trip to the cabin that day.

OUR LAST VIEW OF THE WHITE SHEEP

At an early hour the next morning the little tent was taken down and cached with other articles, to be called for the following day, and then with heavy packs we began trudging along the slight rise to the low divide, through which

Photo by George Shiras, 3rd

THE SENTINEL EWE

After a long stalk on all fours the author got within 50 feet. Note the extremely long legs of the ewe. The short black horns and white body have led many of the Alaskan miners from the Rocky Mountain States to mistake the ewes of these sheep for white mountain goats (see pages 485 and 486).

Cottonwood Creek ran on its short and rapid career to Skilak Lake, 3,000 feet below.

It was here that I got my last photographs of rock ptarmigan, and as we climbed up on the broken mass of rock, littering the pass between the cliffs of the divide, I put away the lenses and boxed the camera in case of a fall through such insecure footing. Half way through the pass some one noticed seven or eight sheep, almost overhead, lying on a narrow ledge, with a perpendicular drop of nearly 300 feet below them. To those who have seen large, white gannets, nesting here and there upon the face of a maritime cliff, the resemblance was a striking one. Before I could get the camera out and arranged, the sheep, noticing that we had stopped and were gazing upward, became alarmed, and in a series of awe-inspiring leaps took ledge after ledge until the top was reached, when, getting in line, they all looked over. And that constituted my last but still lingering picture of these graceful creatures, poised on the highest summit above Skilak Lake.

Impressed once more with the agility and self-confidence of these nomads of the skies, I asked Tom whether he had ever seen the remains of any indicating that sometimes life paid the forfeit of a careless gambol or in the desperate effort to avoid pursuit. He replied that during nearly 16 years in the sheep ranges of Alaska he had never seen a single case of the kind, though several times having found carcasses at the foot of a snow avalanche.

And then occurred within a few short hours and at the same spot a tragedy constituting a most remarkable sequel to my inquiry.

After returning to the lake and remaining over night, Tom and Charlie started back in the morning for the tent and the remainder of our outfit. In passing through the same divide Tom saw, hanging partly over a ledge and midway between top and bottom, the crumpled body of a large, fine ewe, while running about below was a little lamb, which, whimpering and bleating, continued to look up toward the spot no feet could scale.

Photo by George Shiras, 3rd

BUNCH OF SHEEP, WHICH WERE BADLY FRIGHTENED WHEN PHOTOGRAPHED, RUNNING UP A ROUGH MOUNTAIN (SEE PAGE 486)

How this accident happened is, of course, a matter of surmise; but not unlikely the mother had rushed in between her young and the edge of the great cliff as it gamboled recklessly near, and slipping over left her offspring wondering at the audacity of the leap. But be this as it may, we know that when time passed and the mother failed to return the little fellow by a circuitous trail reached the bottom of the pass, to be no nearer than before to the only one it loved.

Let us trust that before the long hours of the summer day had passed the little lamb saw a white line zigzagging into the valley, which he dimly knew was the pastoral range of his mother's clan, and approaching found a welcome within the ranks, and no less so because he came alone.

SUMMARY OF GAME CONDITIONS ON THE PENINSULA

On our return from the mountain country the camp was located at the further end of Caribou Island, a few miles west of Double-bay camp, and opposite the moose lick.

This island is about three-quarters of a mile long, with a maximum width of a third, and, excepting a few acres of pine, is covered with a vigorous second growth and some swamp land, the result, probably, of the same fire which cleared so much of the shore opposite.

And here it may be remarked that, however wasteful in a commercial sense may have been many of the forest fires in the wilder portions of our continent, they nevertheless have often been of corresponding benefit to the game and range stock. The replacement of dense and often stunted and useless conifers with poplar, birch, cherry, oak, beech, maple, and the subsequent appearance, also, of meadows and glades covered with grass, moss, bushes, and small herbage, has done much in the way of supplying an abundant and nutritious variety of winter and summer food, valuable alike to the larger game animals, domestic stock, pack horses, many game birds, and small quadrupeds, few of which resort to or can thrive throughout the year in the dense, dark evergreens of the North.

In recent years hundreds of thousands of acres of such second growth have sprung up in Alaska, and nowhere has it been of greater advantage to game and

Photo by George Shiras, 3rd

A BIG RAM PHOTOGRAPHED AT 50 FEET FROM AMBUSH

He jumped the instant after the shutter revolved, but left his picture behind him (see page 483). Note the fine and graceful horns

the pack trains than throughout the interior of the Kenai Peninsula. Caribou Island, subjected to easy examination, showed that on the coming of the ice it was visited by many moose, while the abundance of spruce partridges indicated their appreciation of the berries and swelling buds, just as the rabbits thrived on the tender bark and great variety of smaller plants.

In its isolation the Kenai Peninsula is a great Presque Isle, allowing a marked segregation of northern game, favorable alike to their previous existence and now much improved by physical changes, the ease with which the game laws can be enforced, the concentration of Indian settlements near the canneries, and the practical extermination of the wolf.

Reports of those best acquainted with present conditions show that the moose have been increasing steadily in recent years, that the white sheep are thriving, and all other game animals except the small fur-bearers and the caribou are holding their own. Just why the caribou has approached extinction no one seems to know, but I am glad to report that a good-sized stag was seen south of Benjamin Creek by a party of surveyors during last July. As much of the peninsula is well adapted for caribou or their near relatives, the Siberian reindeer, an effort should be made for their introduction, since the interior will readily support a herd of many thousands. As they feed upon a form of ground vegetation now going largely to waste, their presence will not prove a detriment to the other game animals, but on the contrary will afford

an additional supply of meat for visitors and natives, besides largely decreasing the drain upon the moose and sheep.

On several occasions it has been suggested that the peninsula was just the place to establish a national park, but its remoteness and the need of developing such resorts nearer home make such a plan impracticable at the present time. Neither should this country be set aside as a permanent game refuge, because the narrow base connecting it with the main shore is traversed by a great glacier, practically cutting off the egress of the animals, and it thus lacks the essential prerequisite of every such refuge, where the surplus animals should have a chance to populate the surrounding territory.

The district, defined on the map facing page 428, is the most accessible and probably the most populated sheep range on the continent. Here on a few of the more northerly mountains I saw some 500 sheep, and here, too, is the summer range of many moose and the home of the great brown bear. In many other localities big game is plentiful, and it may prove on investigation that in the great stretch of unexplored mountains facing Prince William Sound there are white mountain goats and some specimens of the glacier bears.

THE GREAT ICE-CAP

The sheep country, between Skilak and Tustumena lakes, is walled in on the east by an immense ice field, the history of which has never been written, and only of late has its true character been determined. Marked on the older maps as the Kenai Glacier, it is in reality a great ice-cap, probably unsurpassed on the northern continent except by that of Greenland and the well-known Malaspina ice field at the base of Mount Saint Elias.

Unlike a true glacier—created by ice streams flowing from the higher lateral valleys—this great ridge of ice, towering 4,000 feet above the sea, fills the lower valleys with hundreds of glaciers, some of which are active and still topple great masses of ice into Resurrection Bay, while others are stationary, or receding, but contributing to the flow of nearly all the streams originating south of Skilak Lake.

No one has ever crossed it at the widest point, and no one has ever traveled its entire length. Computations from various sources show this ice field to be 70 miles in length with a maximum width of 20 miles.

Whether originally formed by local precipitation, now insufficient to maintain its present bulk, or whether this ice ridge is a great keel of a mighty ice field which once bore down upon the peninsula, is a problem for the geologist rather than the casual visitor.

The first week in August Skilak Lake suddenly rose a foot in a single night, and the only explanation was that the ice stream below the cap had become clogged for days and, when the pressure became too great, burst its bonds. The milky and turbid condition of the lake corroborated this view.

The weather conditions during the trip were most favorable for game, although we were undoubtedly fortunate in being there during an unusual season.

In 55 days rain fell during 19 hours—practically a drouth. We were windbound three days and experienced a number of violent squalls lasting an hour or so. There were three entirely cloudy days and half a dozen partly so. This resulted in unusually high water in all the mountain streams—an anomaly during dry weather further south, where rain and not melting snowbanks maintained the streams. As a secondary result the mosquitoes were scarce, with the swamps dry; but the black flies, beginning in September, were the worst I ever saw, nearly devouring the men alive as they toiled at the tracking line on the return up the Kenai River.

The maximum heat the last two weeks in July was 87°, on the 19th instant, and the minimum 40°, on the night of the 21st. The average maximum for that period was 70° and the average minimum 45°.5. In August the maximum was 83°, on the 7th instant, and the minimum 32°, on the night of the 10th. The average maximum for the month was 69°.2, and the average minimum 46°.5. The first

week in September the maximum was 67°, on the 1st, and the minimum 28°, on the night of the 2d. Part of this time we were in the mountains, but the weather continued so warm that the altitude did not materially affect the average.

Undoubtedly we were in the most favored portion of the peninsula, and there during an unusual season besides. Often rain and fog encompassed the higher mountains, and frequently we could see storms moving up and down Cook Inlet. Moreover, the great mountain range on the east undoubtedly cleared the wind of moisture before reaching us.

Hunting parties coming out later reported bad weather during the last of September and in October, so the above data must be taken rather as an evidence of what the weather can be than what it is apt to be.

In the winter months the snow is not deep in this region, and for causes already suggested. Last winter, when the middle and easterly States were experiencing the severest weather in 40 years, it was unusually mild on the Kenai Peninsula, because during the fall and winter a continuance of southeasterly winds held the Japanese current close against the Alaskan shore, and at a time when the Arctic cold waves were sweeping over the central and Atlantic coast States. Whether these counter-currents were correlated or whether they were coincidental and of no significance is a matter for the expert meteorologist to investigate.

In conclusion, let us hope that those interested in the permanent prosperity of the Kenai Peninsula appreciate the value of an abundant and available supply of game-food animals and fish, and understand how much the presence of this game has contributed to its fame throughout the world.

The shipment each fall of thousands of pounds of moose and sheep meat from the Kenai Peninsula to the mining towns of Valdez and Cordova is only of a temporary and trifling benefit to a few market hunters, and will some day prove a costly loss.

Long after the last flake of gold has been panned from the sands and the last blast has fractured the veins of quartz, the Kenai Peninsula should continue to be the home of the giant moose and the place where the sheep, the grouse, and the salmon are worth more in dollars and more in life than all the visionary or fleeting fortunes beneath the soil.

AMERICA'S MOST VALUABLE FISHES

By Hugh M. Smith

United States Deputy Commissioner of Fisheries

THE answer to the question, What are the most important fishes in American waters? is likely to vary with the geographical distribution of the persons addressed.

The average citizen who lives within the sphere of influence of the sacred fish effigy hanging in the Massachusetts State-house will undoubtedly name the cod and its allies that frequent the inshore waters and the great submerged "banks" lying off the coasts of New England, the British maritime provinces, and Newfoundland.

From the Hudson to the St. Johns, a primary vote would probably favor the shad and herrings among river fishes, and the bluefish and squeteague among marine species.

Along the 1,700 miles of low-lying coast that extends from Key West to the Rio Grande, the fishermen and the fish-eating public can hardly conceive of anything more important in the way of food fish than the mullets and snappers.

Throughout the Great Lakes the whitefishes, trouts, and pike perches are so abundant and support such extensive fisheries that they would undoubtedly be awarded front rank by millions of people in the States abutting on these waters.

In the vast region drained by the Mis-

Photo by Shirley C. Hulse

AN UNUSUALLY FINE MALE CHINOOK SALMON: WEIGHT, PERHAPS 60 POUNDS. THIS IS THE MOST MAGNIFICENT OF ALL THE SALMONS

sissippi and its tributaries, such homely species as the catfishes and buffalo-fishes attain their greatest development, and originally contributed more than any others to the income of the fishermen and the food supply of a score of States; but these natives have now been supplanted by an Asiatic alien which, having received a course of cultivation in Germany, came to our shores because of inducements held out by our government, and now, under the inaccurate name of German carp, has become the most important inhabitant of our interior waters.

Finally, practically every person on the Pacific seaboard will, without hesitation

Photo by Prof. Henry B. Ward

SALMON BELOW AND IN A FALLS IN AN ALASKAN STREAM

The leaping powers of the salmon of the North Atlantic have been amply praised in prose and poetry. Not less worthy of admiration are the skill, zeal, and persistence with which the North Pacific salmon overcome obstacles, ascend rapids and cascades, and surmount falls while on their way to their spawning grounds. The bull-dog pertinacity with which the fish continue on their course while rapidly undergoing physical de-

or fear of contradiction, assign the foremost place among fishes to the salmons, which, entering every stream from Golden Gate to Bering Strait, constitute the most conspicuous element of the fish life.

The last estimate is the correct one, for the Pacific salmons are the most valuable fishes not only of the United States, but also of the entire western hemisphere, and, with the single exception of the sea herrings, are commercially the leading fishes of the world.

THE FIVE SPECIES OF PACIFIC SALMONS

The Pacific salmons constitute a distinct group, closely resembling the Atlantic salmon, but separated by marked anatomical and physiological peculiarities.

There are five distinct species, which, having many characters in common, nevertheless differ strikingly in size, color, habits, distribution, food value, and economic importance. All of the species occur on the California coast (to San Francisco Bay or a little further south), and range thence to the far north, crossing to Siberia and reaching southward into Kamchatka, while three of them extend to Japan.

These fishes were first christened in a scientific way by the German physician Walbaum, who, in 1792, invested them with the vernacular names by which they were known among the Russians. The rules of nomenclature require that these names be retained, and hence these beautiful creatures must bear for all time such outlandish names as *kisutch* and *tschawytscha*. It was as late as 1861 that Dr. George Suckley, the naturalist of the Pacific Railroad Survey, recognizing the generic distinctness of these fishes from the ordinary salmons (*Salmo*), gave them for the first time a clan name of their own, *Oncorhynchus*, meaning hook snout.

The largest of the genus, and the most magnificent of all the salmons, is the chinook, quinnat, king, spring, or tyee salmon. It has an average weight of nearly 25 pounds in the Columbia, and is often caught weighing 40 to 60 pounds, while occasionally examples of over 100 pounds are taken. While found from California to China, it attains its greatest abundance in the Sacramento, Columbia, Yukon, and other large streams.

The species called blueback salmon on the Columbia, sockeye on Puget Sound, and redfish or red salmon in Alaska, averages only five pounds in weight and never exceeds twelve. It attains greatest abundance in the Columbia, the Fraser, and in various streams throughout Alaska. Its meat is rich in quality and deep red in color, and the fish is therefore in great demand for canning. While a beautiful fish when in salt water, with bright blue back and silver sides, after entering fresh water it deteriorates rapidly in food value and appearance, the head turns to olive green, and the entire back and sides become crimson and finally dark blood red.

The silver or coho salmon, with a general distribution in the coastal streams, averages 6 pounds in weight and rarely exceeds 25 or 30.

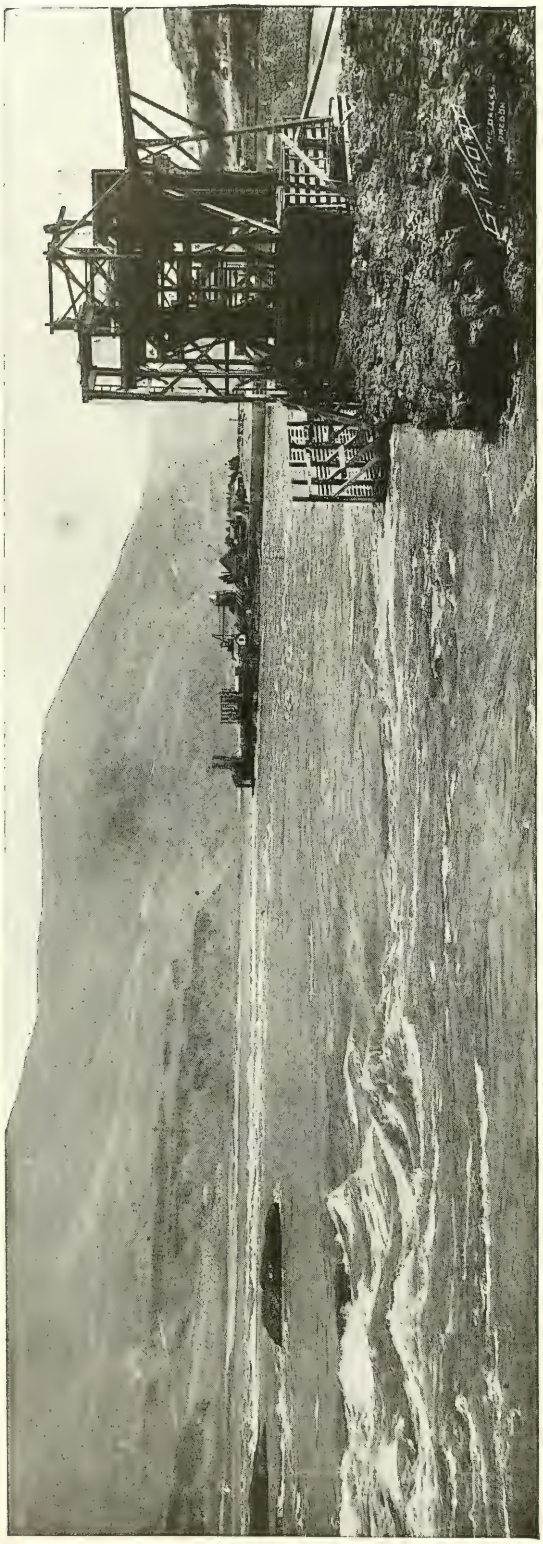
The smallest species is the humpback, so called from the well-marked nuchal hump developed by the male in fall. The extremes of weight for mature examples are 3 and 11 pounds, with 4 pounds as the average. The region of greatest abundance is Puget Sound to southeast Alaska.

The remaining species, the dog or chum salmon, averages 8 pounds in weight. It is generally distributed and abundant, but, owing to the poor quality of the flesh, is the least important of the group. The distortion of the jaws in the male during the breeding season, while characteristic of all the species, is particularly marked in the dog salmon.

INEVITABLE DEATH AFTER SPAWNING

The differences in spawning times and places of the different species of salmon are most interesting. After spending most of their lives at sea, growing, accumulating fat, and storing energy, the salmons move inshore and ascend the streams. After once beginning their upward journey, they take no food, and in fact are physiologically incapable of digesting and assimilating food.

The quinnat salmon begins to run in spring and pushes its way to the headquarters of the larger streams. In the



A STATIONARY SALMON WHEEL: THE DALLES, COLUMBIA RIVER

Photo from Dr. H. M. Smith

The salmon wheel has been called the apotheosis of the dip net. It consists of a series of scoops arranged on the priphery of a wheel, which is kept turning by the current. Such wheels, on shore or on scows, are used only in rapids of the Columbia River, and the salmon migrating upstream are caught in large numbers.

Columbia basin the species distributes itself over 90,000 square miles of Washington, Oregon, Idaho, and Montana, its upward limit being insurmountable obstructions or falls. *In the Snake River and the Yukon River the spawning grounds lie 2,000 miles by water from the sea.*

The spawning streams of the red salmon are those that arise in lakes, and the spawning grounds are in the affluents of those lakes. The run begins in May and fish continue to come in until October, depending on latitude.

The silver salmon enters the streams from July to October or November, but does not as a rule ascend for long distances.

The humpback runs into fresh water in summer and fall, preferably in short coast streams, and often spawns within a few rods of the ocean.

The schools of dog salmon come into the stream rather late; in the Columbia River and Puget Sound the run extends from August to late in November, and in Alaska the height of the season is about the first of September.

Now, whether the salmon travel in the streams 2,000 miles or 200 feet to reach their spawning grounds, and regardless of their physical condition at the time they arrive at the particular places required for the proper development of eggs and young, every individual of every species dies shortly after spawning. This is the most characteristic and remarkable event in the life of the Pacific salmons.

Why this is the case is one of nature's mysteries. It has its parallel in some other fishes, in the may-fly, which

Photo from Dr. H. M. Smith

SEINING SPAWNING SALMON IN THE SACRAMENTO RIVER, IN CONNECTION WITH A HATCHERY.

perishes after a few hours' existence, and in the annual plants. We can only say of such that they have served their purpose and are no longer needed.

The death habit of the salmons was doubtless developed to prevent the overstocking of streams, the exhaustion of the food supply of the young while in fresh water, and the consequent danger of the wiping out of species by mere excess of numbers. This wise precaution of nature has become a positive detriment by the appearance of the human factor on the scene and the resulting destruction of a large proportion of the run of each species each year in practically every stream before the spawning act has occurred.

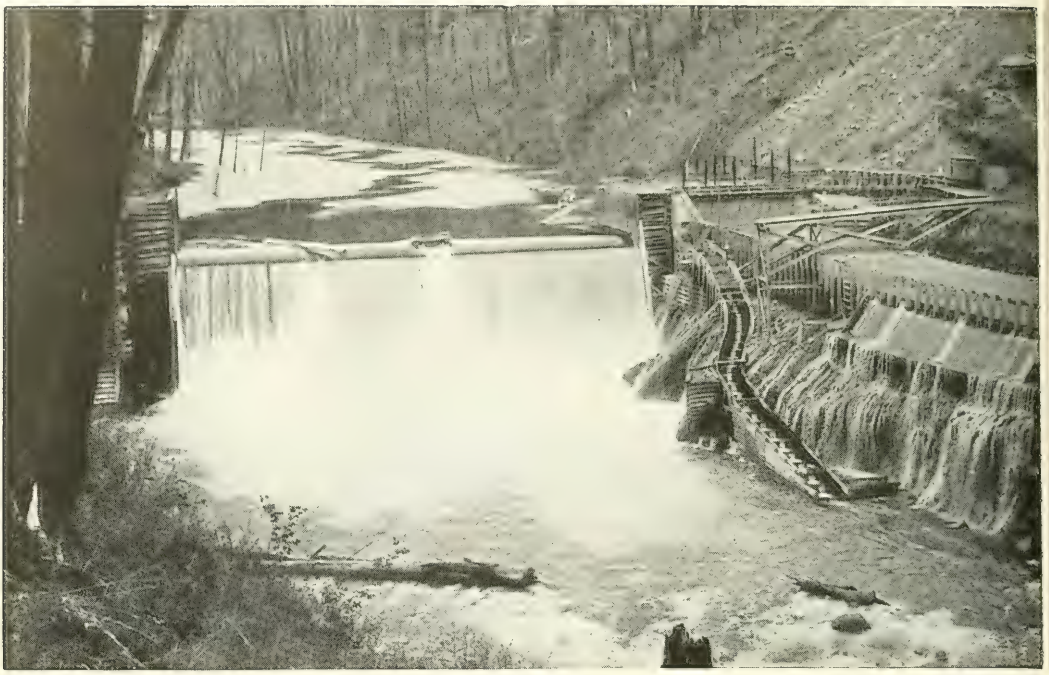
PERIODICITY OF THE RUNS

While the Pacific salmons run with more or less regularity, year after year, two of the species exhibit, in particular streams or regions, a marked periodicity in abundance which is so well established that it can be predicted with certainty years in advance.

The blueback, or sockeye, in certain streams shows a climax in abundance every fourth year. This is especially marked in Puget Sound and Fraser River, where the years 1905 and 1909, for example, were characterized by immense runs, while in 1906 and 1910 the abundance, as shown by the catch, was only one-fourth or one-fifth as great. The quadrennial periodicity in Puget Sound is strikingly shown by the fish caught and canned during the years 1903 to 1910, as follows:

1903	167,211	cases
1904	109,264	"
1905	*825,453*	"
1906	178,748	"
1907	93,122	"
1908	170,951	"
1909	*1,097,904*	"
1910	248,014	"

The case of the humpback salmon in the Puget Sound region is perhaps the best marked example of periodicity. The species there is biennial in its appearance. One year it comes in incalculable numbers, crowding the streams, filling the



THE CAZADERO DAM, ON THE COLUMBIA RIVER, OREGON

Note the fish ladder just to the right of the dam. The fish attack the fall along its entire length, but the best place from which to photograph them is in the corner under the head of the ladder. The Cazadero Dam is 40 feet high, so of course it is impassable, but the fish never seemed discouraged. Morning and evening, all during the run, they leaped at the foot of the apron, apparently undaunted by the heavy blows received in landing on the bucket or the rocks (see photos, pages 506 to 515). The hatchery is located in a curve of the big flume leading from the dam, and about a quarter of a mile downstream. Photo and note by Shirley C. Hulse.

nets, and giving canners all the raw material they can use. The next year the species is so scarce as to be practically absent.

In 1907 the Puget Sound canners prepared 433,423 cases of humpbacks, but in 1908 they were able to secure only enough fish to make 6,075 cases. In 1909 the pack was 370,993 cases, while in 1910 only 108 cases could be filled. During the six even years immediately preceding 1908 the statistics show no humpbacks whatever canned.

This periodicity is an indication of the age of the fish when mature. In the case of the blueback, a large run, with the deposition of a large quantity of spawn, has its major effect four years later in the same region—that is, the normal life of this species, from its birth as an egg to its death as a parent, is four years. The humpback, on the other hand, is a biennial species, a heavy run, with a corresponding egg crop, having its effect two years later. Dr. Charles H. Gilbert, who has made prolonged studies of the Pacific salmon in the interests of the government, announces, as a practically accurate statement of fact, that the humpback dies on its second birthday.

In view of the excellent quality of the humpback and its growing importance as a fresh and preserved fish, the government now proposes to make a determined effort to establish in Puget Sound a large run during the off years. This experiment will extend over several seasons, and will involve the transfer from Alaska of perhaps a hundred million humpback eggs for hatching on Puget Sound. If successful it will prove tremendously important commercially, and incidentally the efficacy of artificial propagation will be submitted to a crucial test.

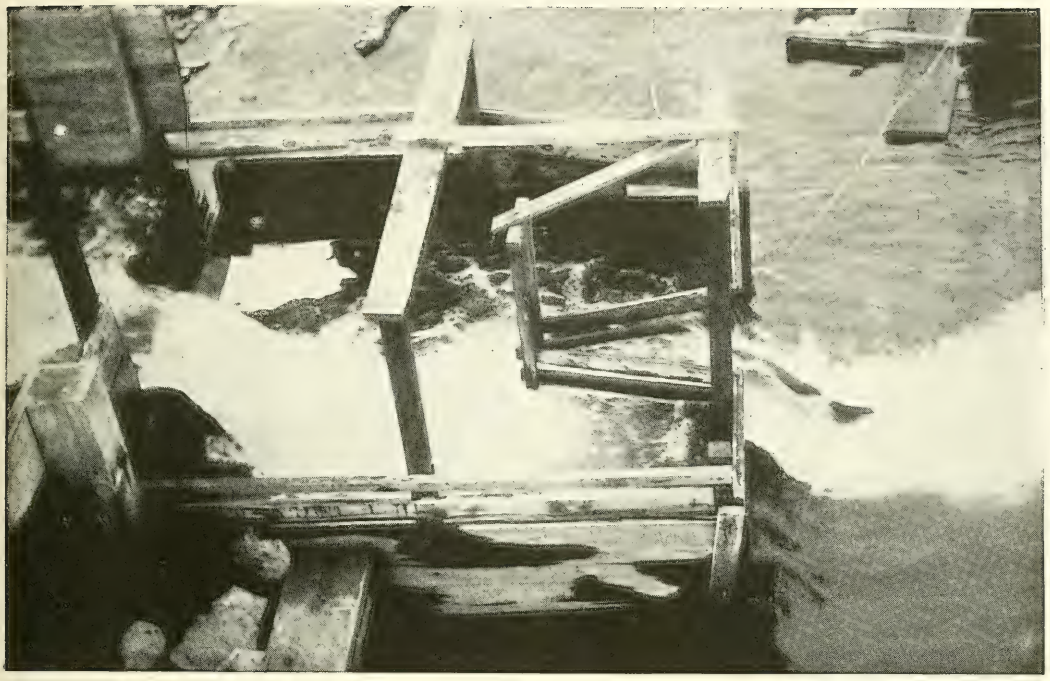


Photo by Shirley C. Hulse

SALMON ENTERING THE FOOT OF THE FISH LADDER

This is used as a trap, and as fast as the fish are "ripe" they are taken out and spawned artificially (see pages 502-509)

THE SALMON'S "INSTINCT OF NATIVITY" AND THE PARENT-STREAM THEORY

One of the most deeply seated and widely entertained theories regarding the salmons (and other species of similar habits) is that by virtue of a mysterious faculty, which has been called the instinct of nativity, these fishes return to spawn in the same stream in which they were hatched.

The advocates of this view find support for it in some well-known facts in the life of the salmons, such as the occurrence of distinctive runs in particular streams, the return of marked fish, response to plants of large numbers of young, etc. Without entering into a discussion of this question, it may be said that in so far as the theory is borne out by facts, the latter may be explained without the necessity of investing the salmon and other anadromous fishes with a higher order of intelligence than is possessed by any other creatures.

It is true as a general proposition that the fish hatched in a particular stream return to that stream to spawn, but this is largely because that is the most natural and most accessible place to go, and it is more remarkable when they go elsewhere, as they frequently do.

The schools of salmon when sojourning in the ocean, preparing for their all-important function, do not roam many miles distant from the mouth of the particular stream in which they were born and spent the early months of their life. Having reached the proper age, they are impelled by the spawning instinct to move shoreward, and they eventually come within the influence of the fresh water discharged into ocean, gulf, or bay by a stream that is more likely to have been the "parent stream" than another. It thus happens that streams pouring a vast volume of fresh water into the sea, like the Columbia and Fraser, and streams whose mouths are more or less remote from others, like the Sacramento, are likely to induce the return of a large

Photo by Shirley C. Hulse

REMOVING THE EGGS FROM A RIPE FEMALE (SEE PAGES 503, 506, AND 507)

proportion of the fish that originally proceeded therefrom.

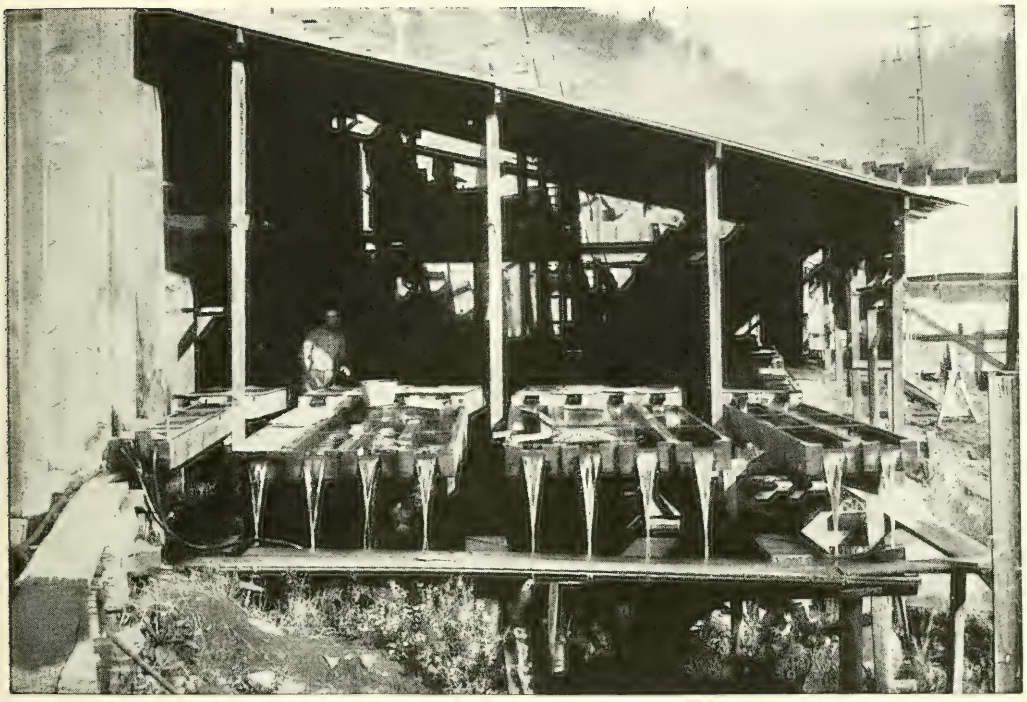
On the other hand, there is no reason to doubt that the salmon spawned in contiguous coastal streams or in particular tributaries of a large river return indifferently to any of those streams or tributaries, depending on conditions (storms at sea, floods, temperature of coastal or river water, enemies, etc.), which vary from season to season.

GOVERNMENT AND STATE EFFORTS TO INCREASE THE SALMON SUPPLY

The artificial propagation of salmon in the streams of the Pacific seaboard began at a comparatively early date and has continued with yearly increasing extent and importance, so that at the present time more hatcheries are devoted to the Pacific salmons than to any other fishes of the Western Hemisphere. The vast interests at stake have appeared to warrant and to require all the money that could properly be expended by the Federal and State governments for salmon culture.

It was believed at the outset that dependence would have to be placed on artificial propagation to offset the tremendous drains made on the supply by man and other destructive agencies, and it was generally maintained at a very early period in the history of the salmon industry that with adequate cultivation the fisheries could increase almost indefinitely.

The first salmon hatchery in the West was established in 1872, on the McCloud River, in California. By executive order there was set aside a large tract for a "piscicultural preserve," which was fittingly named Baird, after the first national commissioner of fisheries; and Livingston Stone, a pioneer fish culturist, who is still alive, was placed in charge and continued in that capacity for many years, overcoming many obstacles, under-



A FIELD HATCHERY OF THE STATE OF OREGON

Here the eggs are put in troughs of running water, in which they hatch after a greater or less period, according to the temperature of the water. The eggs are picked over every day and all sterile or objectionable ones are thrown out. It is necessary to screen the troughs at this place on account of birds, which enter boldly and steal the eggs. The water ousel is the worst of these thieves. Note and photo by Shirley C. Hulse.

going many privations, repeatedly subjected to great danger from attacks of Indians and outlaws, and devising methods which showed the possibilities of salmon culture and led to the present extraordinary development of this art.

The original Baird hatchery, still in active operation, is now supplemented by numerous other government stations, which may be regarded as lineal descendants. Two of these are in the Sacramento Valley, in California; four are in the Columbia basin, in Oregon and Washington; four are in the Puget Sound region, and two are in Alaska. The three Pacific-coast States now maintain more than 30 salmon hatcheries, the largest number being in Washington. In British Columbia 11 hatcheries are operated by the government.

A feature of the salmon industry which is not met with in any other branch of the fisheries has been the establishment and maintenance by private interests of hatcheries on various parts of the coast. At present this practice is confined to Alaska, where, in 1911, five hatcheries belonging to canning companies produced and liberated many millions of young red salmon.

THE VAST EXTENT OF SALMON CULTURE

The eggs of the salmons are .2 to .25 inch in diameter, and are the largest handled by the fish culturist. They are easily obtained by intercepting the fish on their way to the spawning grounds by means of racks, traps, seines, etc., and then, when exactly ripe, by expressing by firm pressure on the abdomen.

The size and activity of the salmons make it necessary for two or three men to work together in holding the fish and relieving them of their eggs and milt, and the largest individuals are most readily managed by putting them in a straight jacket.

Photo by Shirley C. Hulse

A CHINOOK SALMON MAKING A LONG, CLEAN JUMP ONTO THE APRON OF THE DAM: FISH 25 FEET FROM CAMERA (P. 500)

SALMON ATTEMPTING TO SURMOUNT THE CAZADERO DAM (SEE PAGE 500): FISH 25 FEET FROM CAMERA

The leaping salmon are hard to photograph. The water reflects a great deal of light and the fish very little. One may take a good picture of either the water or the fish, but to get both on the same negative is the difficulty. I have purposely forgotten how many rolls of film I spoiled before I got good pictures, but they were not a few, and with each attempt at fish photography I always expected and usually got a thorough soaking from the icy spray of the falls and a hard tumble or two on the slippery rocks. Photo and note by Shirley C. Hulse.

Photo by Shirley C. Hulse

FISH 10 FEET FROM CAMERA

In view of the inevitable death of the salmon after spawning, an improvement over the old method of forcible expulsion of the eggs is the stunning of the fish by a blow on the head and the taking of the eggs by abdominal section. This, while greatly facilitating the work of the spawn-takers, adds approximately 10 per cent to the egg yield by the saving of eggs that would ordinarily be left in the abdominal cavity.

Salmon eggs hatch slowly. Incubation, beginning in late summer or early autumn, continues until the following spring or summer, depending on the temperature of the water. The most protracted period of incubation thus far coming to the notice of fish culturists is that of the red salmon at Karluk, Alaska, where eggs taken in September may not hatch until the following May or June, and in certain seasons the hatching time has been prolonged to 270 days.

The annual deposits of young salmon in the waters of the Pacific seaboard by the Bureau of Fisheries, the three coast States, the province of British Columbia, and the private hatcheries in Alaska now total from 450 to 500 million, of which the largest quantity represents the work of the Federal government.

The human effort represented by this

This big fellow jumped directly at me as I stood near the edge of the apron, and as I dodged him I unconsciously snapped the camera. The fish was only three or four feet away, and he threw water all over the camera and nearly ruined it. Photo and note by Shirley C. Hulse.

tremendous output may perhaps be better appreciated when a season's take of eggs is considered as a commodity. The average number of salmon eggs to a bushel may be given at 125,000. The number of eggs taken, fertilized, and incubated by the United States Bureau of Fisheries at its California, Oregon, Washington, and Alaska hatcheries in 1911 was equivalent to 1,500 bushels. The salmon-egg harvest of the other efficient agencies indicated would bring the yearly total up to 4,500 bushels.

HOW MAN IMPROVES ON NATURE

In the discussions of important economic questions affecting natural resources, especially animals, the contention is sometimes made that man cannot improve on nature's methods. This plea, which impresses many people and conduces to neglect of the needs of some of our most valuable creatures, is most emphatically and clearly refuted in salmon culture.

It is a matter of general observation that nature is most prodigal in producing fish eggs and young far in excess of the needs of the species, and permitting the destruction of a very large percentage of the progeny before maturity is reached. With the advent of the human factor, there is a disturbance of the nice balance that had come to be established, and it is then that fish culture is demanded and justifies itself by saving a large proportion of the eggs and young that are ordinarily sacrificed.

Just how effective are the operations of the salmon culturist, and how strongly artificial propagation is now demanded because of the enormous drains that are made on the small remnants of the original progeny that have reached the reproductive age, may be seen from the following comparison:

Under ordinary conditions of natural propagation, a certain small percentage of the ripe eggs are not extruded, but remain within the body of the female, and are therefore wasted; from 10 to 20 per cent of the total number of eggs escape fertilization; a very large proportion (60 to 80 per cent) of the eggs are

Photo by Shirley C. Hulse

SALMON LEAPING OVER THE SWIFT WATER NEAR THE TOE OF CAZADERO DAM AND SEEN FROM ABOVE

destroyed by predaceous fishes and other agencies; and, while the newly hatched young are in the helpless non-swimming stage, burdened by the heavy yolk-sac, they are such easy victims and such dainty morsels to the myriads of fishes that infest the spawning grounds, that an additional loss of 10 to 15 per cent occurs, so that of the original crop of eggs, only 1 to 2 per cent reach the age to which the fish culturist carries the young salmon.

Under the present effective methods of artificial hatching, the total losses up to the time when the young are set free in the rivers, amply able to care for themselves, although still liable to considerable mortality before reaching the ocean, are not more than 20 per cent, are frequently only 10 per cent, and should not exceed 15 per cent under average conditions.

Therefore, as against an absolute loss of 98 or 99 per cent in nature, the fish culturist is to be credited with a saving of 85 per cent.

The natural mortality among young salmon in the rivers decreases rapidly as the fish become stronger, more active, and more alert. The most important advance that salmon culture can make will therefore be in retaining the young at the hatcheries for a longer period before turning them loose in open waters to shift for themselves. There is no particular difficulty in rearing salmon in captivity; the difficulty lies in providing at a given hatchery the necessary artificial pond area in which to hold and feed perhaps 100 million rapidly growing fish.

EXTENT OF THE SALMON INDUSTRY

The salmon industry on the Pacific coast owes its origin, rapid development, and present extent to the establishment of canneries. During the 50 years that

have elapsed since salmon canning began, more than 85 million cases (each holding 48 one-pound cans or the equivalent) have been packed. The fresh weight of the salmon entering into this output has been over five billion pounds. Recent years have witnessed marked changes in the relative amounts of salmon canned, salted, and sold fresh or refrigerated, but much the largest proportion of the catch is still canned, and this will necessarily be the case for years to come.

Salmon fishing is conducted throughout the range of the salmons, but the industry is most extensive in or near the mouths of certain streams, chief of which are the Sacramento, Columbia, Fraser, Skeena, Karluk, and Nushagak. Most of the fishing in Alaska is in bays, straits, and sands adjacent to small streams.

In 1909 the aggregate catch of salmon in the Pacific States, British Columbia, and Alaska was upward of 400 million pounds, which, as sold in a canned, salted, smoked, frozen, or fresh condition, had a market value of about $27,750,000. The canned product alone, consisting of more than five million cases of 48 one-pound cans, was worth $25,500,000. Thirty-five thousand people were engaged in the different branches of the industry, and the invested capital was fully $30,000,000.

ALASKA'S ENORMOUS SALMON RESOURCES

Many years have elapsed since Alaska ceased to be "Seward's Folly," because Alaska for a long time has annually more than repaid her purchase price in salmon alone. The salmons have in fact been Alaska's most valuable contribution to the world's needs, exceeding in abundance and importance those of any other region.

The salmon industry may be said to have began in 1878, when the first cannery was operated. The exploitation of the different sections has progressed rapidly, and in 1911 the catch was probably the largest ever made, amounting to about 44 million fish, weighing nearly 208 million pounds.

While all of the five species occur in Alaska, they differ markedly in distribution and relative abundance. The red salmon is most numerous in central and western Alaska, where three-fourths of the catch is obtained. On the other hand, nine-tenths of the output of humpbacks and a large proportion of the other species come from southeast Alaska. The preponderance of the red and humpback species is shown by the fact that of the 44 million salmon utilized in 1911, about 17½ million were the former and 21½ million the latter.

To have transported, in a fresh condition, the output of 1911 would have required a train of 6,900 freight cars, each holding 30,000 pounds of fish. If placed end to end, the fish would have extended in an unbroken line from New York to San Francisco, back to New York, and again to San Francisco.

FEDERAL GOVERNMENT SUPREME IN ALASKA

Interest in the salmon fisheries of Alaska is increased by the fact that they are under the jurisdiction of the Federal government. The remarkable development of the industry and its flourishing condition are to be attributed in great measure to the wise policy adopted by the government in encouraging the utilization of the resources while safeguarding the supply. Under the wise laws made by Congress, supplemented by the large discretionary powers invested in the Secretary of Commerce and Labor, the salmon fisheries ought to remain unimpaired for an indefinite period.

The major key to the situation is the authority to close to all fishing for a term of years any stream in which the extent of the fishing is disproportionate to the number of fish that are allowed to reach their spawning grounds.

Although the fishery force available for patrolling the Alaskan coast is woefully inadequate, yet even in the most remote and seldom visited parts there is a wholesome sentiment for salmon protection, and violations of the law are surprisingly few.

The large fishing companies, with immense vested interests, are vitally concerned in the perpetuation of the salmon supply, and are willing to meet the gov-

Photo by Shirley C. Hulse

A SPLENDID CHINOOK SALMON, PHOTOGRAPHED WHEN ONLY 10 FEET FROM CAMERA

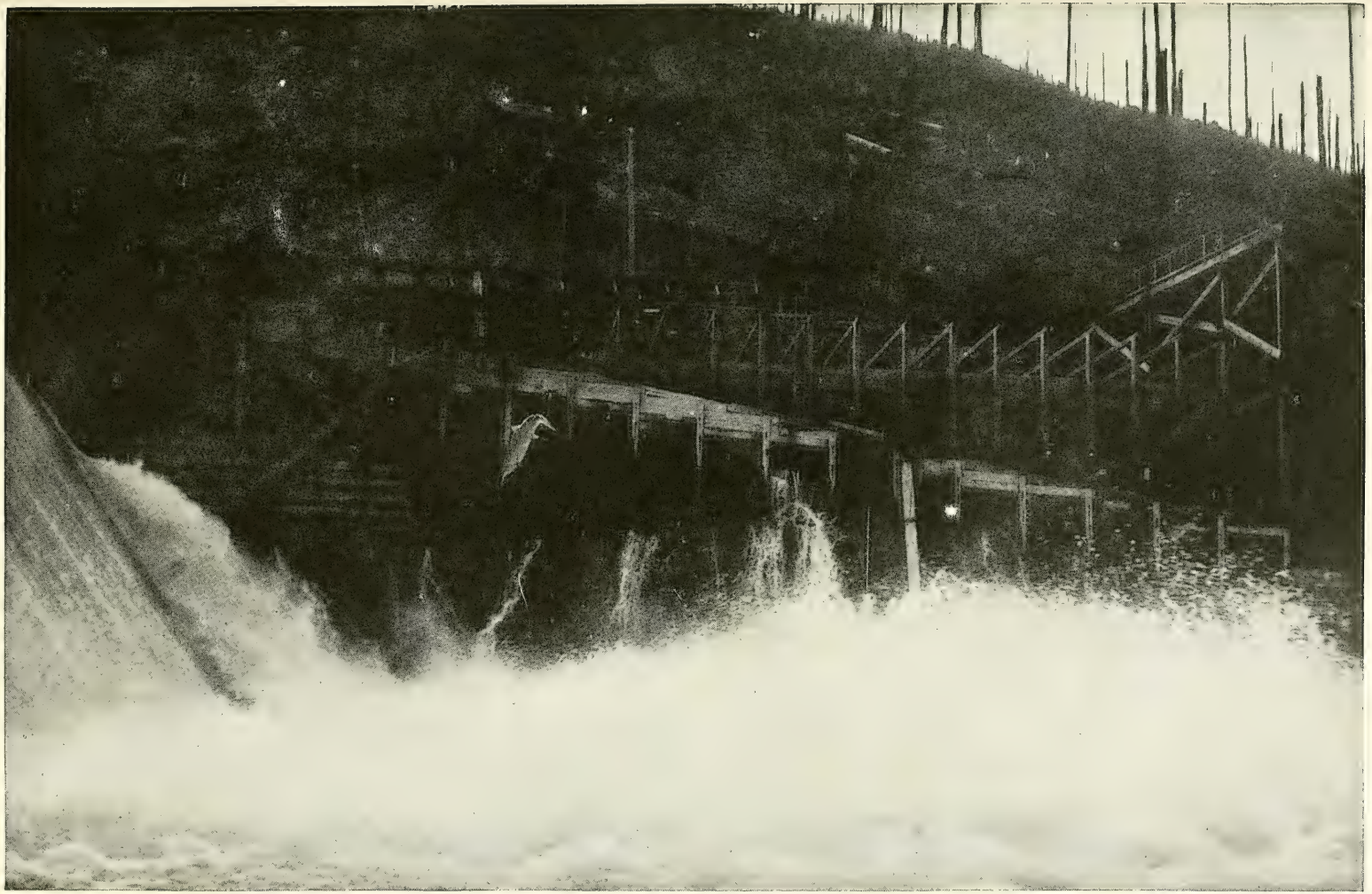
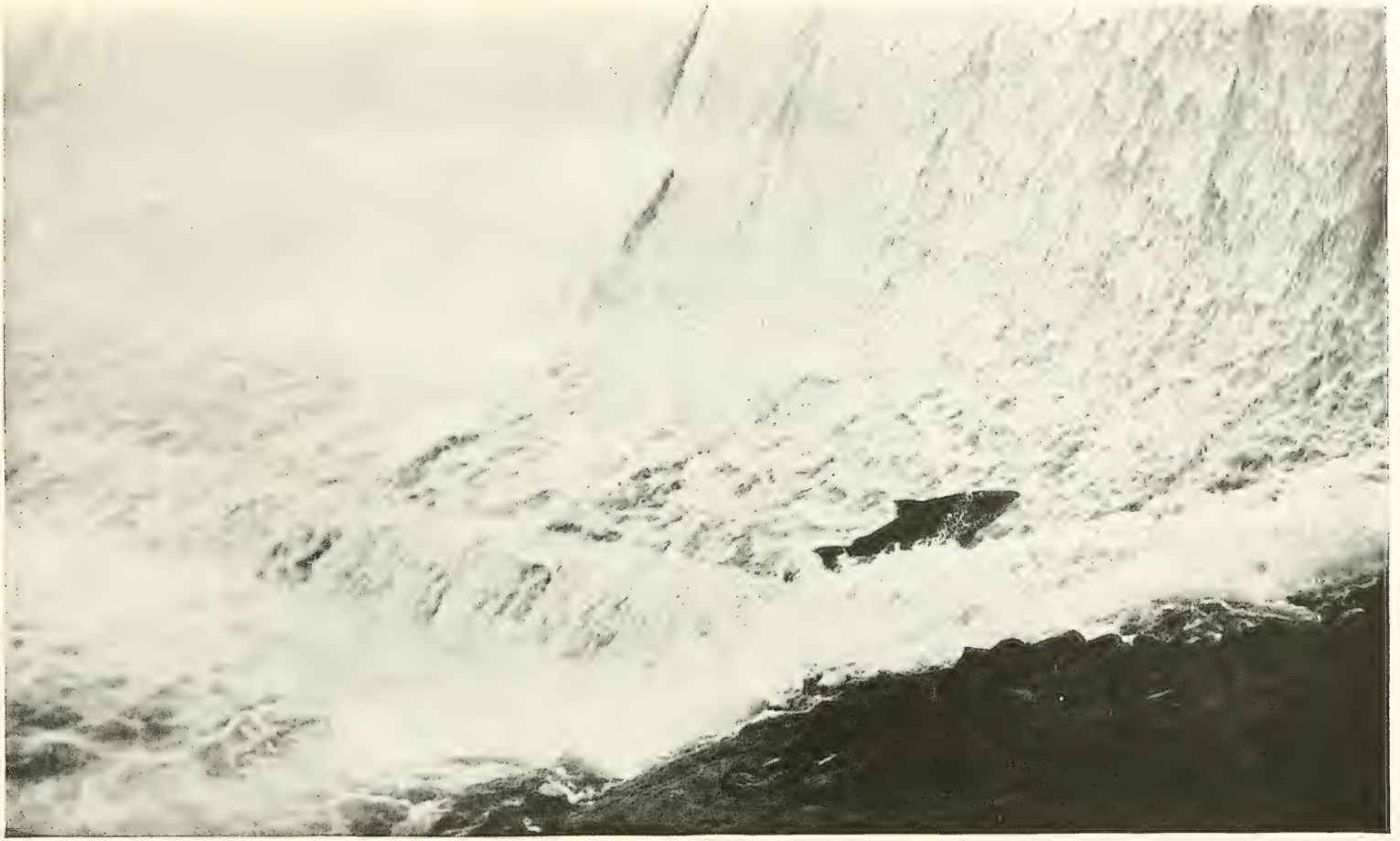


Photo by Shirley C. Hulse

THIS SALMON LEAPED A LITTLE TOO SOON AND WAS WHIRLED OVER AND OVER IN THE AIR



SALMON SWIMMING UP THE SURFACE OF THE APRON IN THE SWIFT WATER BELOW THE CAZADERO DAM

The strength of these fish is evidenced by their wonderful runs through water which would seem calculated to dash them to pieces. No rapid is too rough for them to scale and no fall is too high for them to attempt. I have seen them run under a power-house into the draft-tubes and buck the current till they were washed back, limp and exhausted. They would then retire to a still place, rest up, and come back to try it again. It is said that by leaping and swimming they can surmount a 20-foot fall, and I believe that there is no doubt that they can make a 12-foot fall. Photo and note by Shirley C. Hulse.

Photo by Shirley C. Hale

AFTER LANDING ON THE APRON, THE FISH ARE PROMPTLY WASHED BACK TO THE POOL BY THE CURRENT, ONLY TO TRY IT AGAIN AND AGAIN

ernment half way in inaugurating and enforcing measures for the prevention of overfishing or other destructive methods.

One of the most novel and interesting pieces of work conducted by the Bureau of Fisheries in connection with the administration of the Alaska salmon fisheries is the taking of a census of the spawning salmon moving up one of the principal streams in the territory. The results and the purport of this effort are most important, and a brief account is not out of place here.

Since 1907 Nushagak and Wood rivers, which flow into Nushagak Bay, in western Alaska, have been closed to commercial fishing by virtue of the power conferred by law on the Secretary of Commerce and Labor. In 1908, through the liberal coöperation of two salmon companies operating in the region, the Bureau at great expense and labor placed across Wood River an intercepting rack, which compelled all migrating salmon to pass through narrow tunnels or gates provided for the purpose and so arranged that the fish would be readily visible to persons on watch.

Men provided with an automatic counting and registering device were stationed on the rack night and day and kept a tally of the salmon as they passed upstream. The run continued during all of July and part of August, and on one day over 324,000 fish were recorded, and on another more than 402,000. The total tally was 2,603,655 salmon, all of the red species.

These were fish that had escaped the very active fishing in Nushagak Bay, and in addition to them several million other fish are known to have gone up other tributaries of the bay to their spawning grounds, the data available indicating that the total run of red salmon in the Nushagak basin in 1908 was as many as 13,600,000, with 10,100,000 as the minimum, of which 6,400,000 were caught and utilized at the local canneries.

Therefore, under the most favorable conditions for reproduction, nearly 53 per cent of the run escaped, and under the most unfavorable 37 per cent.

During each of the three following years the rack was reconstructed at the same place, and the census of the run was taken in the same way, with the following results: 1909, 893,244 fish; 1910, 670,104 fish; 1911, 354,299 fish. Arrangements have been made to continue the count in 1912, which will be a most important year for the experiment, because affording an indication of the approximate number of fish resulting from the run of 1908.

It is yet too soon to say what this experiment will lead to, but it is the expectation that it and similar trials in other streams will afford accurate data relative to the natural increment of the fish, so that, the approximate size of the run being known, the minimum number of fish necessary to maintain the supply may be allowed to pass to the spawning grounds each year and the remainder of the run placed at the disposal of the fishermen.

IMPORTANT NOTES FOR MEMBERS

The splendid picture of "The Matterhorn," which is published as a supplement to this number, shows the magnificent mountain in its grandest and most impressive aspect. For the convenience of members of the Society a limited edition of the picture has been printed on heavy artist's stock, suitable for framing. Copies may be had, unfolded, for 50 cents each, postpaid.

Members desiring the address of the Magazine changed for the summer months are requested to send notice of the desired change immediately.

Dr. Hiram Bingham has directed our attention to a misprint in the recently published account of his explorations in Peru, as follows: In the quotation from Professor Lull's article, through a clerical error, Dr. Bingham's name was substituted for that of Professor Bowman (first column, line 44, page 417, April, 1912, number).

On page 427 of this number read "Kenai Peninsula" for "Seward Peninsula."

SEED FARMS IN CALIFORNIA

By A. J. Wells

IN 1820 a seed merchant of Philadelphia announced that he had "an abundant supply of seeds," having received from England "300 bushels of garden peas and 400 pounds of onion seed!" Today a single seed farm in California will grow enough onion seed in one field to supply 600 such stores, and one seed merchant will take it all. A single seed-house in Philadelphia now provides floor space equivalent to the area of 16 acres, and such a house will contract with growers in California to furnish seed by the ton and by carload lots of from one to six cars.

Seed-growing has become an established branch of California horticulture, and from these farms the principal seed-houses of the United States and of many parts of Europe draw their supplies.

Seedsmen from half the world visit California yearly to inspect the fields and to arrange contracts, and seeds now go in car lots even to France and to Holland.

Flower and vegetable seeds are generally small, delicate, thinly cased, easily affected by changing weather, injured by dampness, and hard to cure where climatic conditions are unfavorable. Cloudy weather, showers, a driving rain, or heavy wind may, as Shakespeare says, "destroy six months' good hope." But here seeds are grown in a maximum of sunshine and matured without storms or rain or artificial irrigation, faring much as a wild plant fares, save for the constant stirring of the soil. They are cured in the open air, free from all dampness. Harvesting comes on before the rain sets in, and there is no difficulty in drying the seed crops in the field, without the expense of providing barns or miles of sheds for shelter.

The crop is grown only for the seed, and cultivation is directed to the conservation of moisture at the root to maintain a steady but not "woody" or luxuriant growth. The climate of the coast region southward from San Francisco for 500 miles is wonderfully equable and full of comfort for the human plant. It is more radiant, genial, equable and rejuvenating than the famous Riviera, with less atmospheric disturbance and variations of temperature, and is ideal for garden and field plants.

There are seed farms in eight counties of the State, but for the most part the business centers in certain coast valleys between San Francisco and Santa Barbara. Of these, the chief and oldest section is the Santa Clara Valley, about San José, and reaching down into the extensions of this valley, locally known as the Hollister and San Juan valleys. The whole valley is shut away from the sea by the Coast Range, but its climate at the same time is modified by the proximity of the sea, and is a blend of the coast air and the warmer and drier air of the interior.

A more marked coast climate is found in the little valley of Arroyo Grande, 200 miles south of San José. This opens directly upon the ocean, but has the temperature of Santa Barbara rather than that of San Francisco. Still further south is the Lompoc Valley, nearly due east from Point Conception, where the coast line turns sharply eastward, exposing the whole frontage of the land to the southern sun, and taking the west winds at an angle.

The soil of the Santa Clara Valley and its extensions is sedimentary, very deep, black or chocolate brown, and rich and moist. Vancouver described it in 1792 as "a rich, productive mold, superior to any I have seen in America."

The soil of Arroyo Grande and of Lompoc is of a lighter color and finer texture, approaching the loess type in appearance, and is enormously fertile. Locally the latter region has been known for its large production of mustard seed and the former for its great vegetable products. A large seed farm is located in the Arroyo Grande, which has this year, on a single contract, 300 acres of sweet peas.

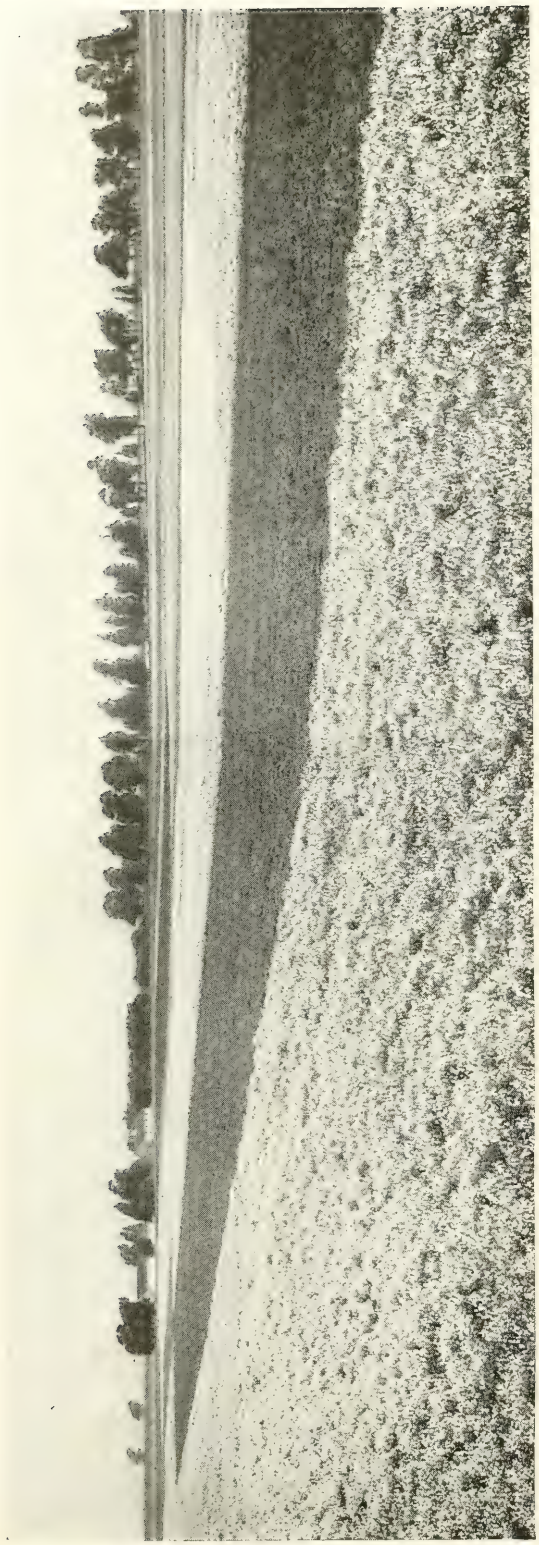


Photo from A. J. Wells

A FIELD OF SWEET PEAS, MORSE SEED FARM, SAN JUAN VALLEY, CALIFORNIA: "FARMS OF A THOUSAND OR FIVE THOUSAND ACRES ARE CARED FOR LIKE GARDENS"

On the seed farm in Arroyo Grande, onions are carried as "sets" to the head of the valley and planted in the higher and warmer soil for the sake of a better seed crop. So elsewhere growers, after the first year, ship the bulbs to the San Joaquin or the Sacramento valleys for the sake of a different soil and air in which to mature the seed, and to escape the blight, which is at once the bane and problem of growers of this seed in many regions.

The delta lands of the valleys just named are among the richest lands in the world, and are known as the California Netherlands. Onions do well the first year in a heavy black soil. Lettuce wants a heavy loam, as do sweet peas, while the radish seeds more quickly and does better in a lighter soil.

Plowing and preparation of the soil goes on from December to February, and most of the planting is completed before midwinter. Needless to say, the seed-bed is well stirred and the soil made fine. Farms of a thousand or five thousand acres are cared for like gardens. March, April, May, and the early part of June are given to steady cultivation and weeding. Seeds are grown without irrigation, save under extreme conditions, and cultivation is almost continuous, that moisture may be kept near the surface.

Much work must be done with the hoe, and hand-work of several kinds is necessary. Thus, certain kinds of lettuce must have the head slashed with a knife, to let the seed stalks out; onions as "sets" must be placed one by one right side up in the row and covered; celery, before being set out in the field, is twice transplanted; and carrots and

Photo by J. O. Tucker

STRIPPING LETTUCE OF DEAD LEAVES: ON A SEED FARM, GILROY, CALIFORNIA

Certain kinds of lettuce must have the head slashed with a knife to let the seed stalks out (see page 516)

Photo from A. J. Wells

A FIELD OF CARROTS IN BLOSSOM: ON A BIG SEED FARM IN THE SANTA CLARA VALLEY, CALIFORNIA

Photo from A. J. Wells

A CORNER OF A FIELD OF CARROTS IN BLOOM : SANTA CLARA VALLEY, CALIFORNIA

Photo from A. J. Wells

A FIELD OF SEED ONIONS IN BLOOM: IN THE SANTA CLARA VALLEY, CALIFORNIA

Photo by J. O. Tucker

TOPPING SEED ONIONS IN THE SANTA CLARA VALLEY, CALIFORNIA: ONION FIELDS VARY FROM 100 TO 600 ACRES

Photo from A. J. Wells

THRESHING ONION SEED IN THE SAN JUAN VALLEY, CALIFORNIA (SEE PAGE 530)

Photo by J. O. Tucker

A FIELD OF RADISH IN BLOOM: SANTA CLARA VALLEY, CALIFORNIA

Photo from A. J. Wolf

FIELD OF RADISH IN BLOOM; PRASLAN SEED FARM, SANTA CLARA VALLEY, CALIFORNIA

Photo from A. J. Wells

HARVESTING RADISH SEED, SAN JUAN, CALIFORNIA: ALL THE WORK OF HARVESTING MUST BE DONE BY HAND

Photo by J. O. Tucker

A FIELD OF SWEET PEAS, 500 ACRES IN EXTENT: SANTA CLARA VALLEY, CALIFORNIA

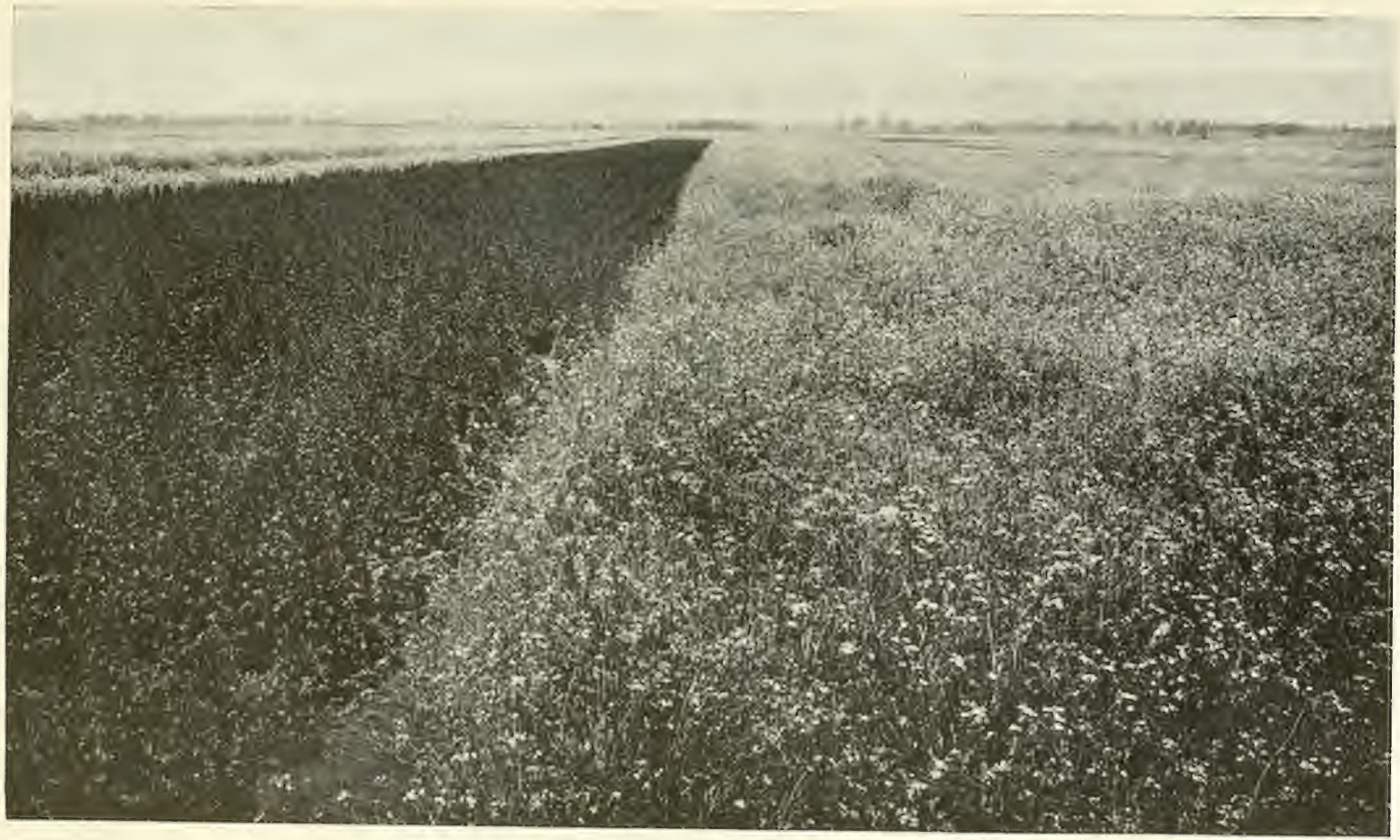


Photo from A. J. Wells

A FIELD OF LETTUCE (ON THE LEFT) AND RADISH (ON THE RIGHT) TWO MILES LONG: NEAR GILROY, CALIFORNIA

Photo by George G. McLean

A CALIFORNIA WILD POPPY FIELD

Photo from A. J. Wells

A FIELD OF GIANT WHITE POPPIES: IN BACKGROUND SINGLE RED POPPIES: SAN JUAN VALLEY, CALIFORNIA

other roots must be gone over, to eliminate all that are defective in shape or color.

Harvesting is largely hand-work, and runs from July to September, inclusive. Work is all done and seeds are threshed and cured before the fall rains begin. Sweet peas are cut with a mower, and are left in the sun for many days to cure. Onions are topped by hand and hauled to the drying ground, and lettuce must be spread out, turned and dried in the sun.

Threshing is done in a variety of ways: by machinery, by rollers, and by the old hand-flail. Onions are threshed and cleaned by machinery, and the seed is then washed, spread out, and dried, the utmost care being taken to insure purity and cleanliness. Special machinery is used for various kinds of seed, electric power being generally available, the clean seed coming down the prepared chutes, at the mouth of which it is sacked.

The list of seeds grown is long, and the variety of single kinds is surprising. "The majors," as they are called, are lettuce, onions, radishes, and sweet peas. One field of lettuce is shown that is two miles long (page 527), and sweet-pea fields embrace from 100 to 500 acres or more. They yield the most in pounds per acre.

Radishes are grown in large tracts, and nearly a dozen varieties of our common table vegetables produce seed by the ton on several well-known farms.

Flowers are a fashion and the demand for seed is extremely variable, but the list is fairly long and the various bright colors, arranged in parallel rows over a hundred acres—or several times a hundred, if sweet peas are included—make what has been called "a veritable carpet of Paribanon."

The sweet pea holds its vogue year after year, and it is a beautiful sight to see a great field of these exquisite flowers. Where the many varieties are separated by the intervention of some other flower or vegetable, so that the pollen will not mingle, the bands of color gather to a point in the distance, perhaps a mile away, a broad belt of many hues.

In England much enthusiasm is shown in sweet-pea culture, and the National Sweet Pea Society holds, in London, an annual show of immense proportions, exhibiting but this one flower.

In that climate the growers produce remarkable blossoms, but at the expense of the seed, and experts and enthusiasts come yearly to California to inspect the sweet-pea fields, to hunt for novelties, to buy seed, and to write of the industry.

By far the largest part of the sweet-pea seed for the world's planting is grown in California. Here the seed is planted long before the Christmas holidays, and flowers are often at their best by the middle of May. Making but little growth during the colder months, they elaborate a strong root system, and as spring comes on, with its steady warmth, they fairly rush up the trellis and break into bloom.

In the fields the grower must be busy as the season advances. The tendency to variation is constant and demands careful attention. Men are seen up to their waists in flowers, on the lookout for "sports," or natural cross-breeds, and for "rogues," or plants which show a tendency to revert to the original strain. "Roguing," as it is called, is the destruction of all non-typical plants, but "sports" are possible prizes, and are carefully scrutinized, for a fine hybrid may be worth a thousand dollars or more.

The sweet pea will illustrate the difficulty. If "roguing" this year is carelessly done, it will "queer" the next year's crop. Or a "break" in the strain may cost much extra labor.

The "Countess of Spencer" is considered the most remarkable varietal break in floriculture. The type is well defined, but from it has sprung a family of many shades and colors, and it has cost the sweet-pea grower much money and effort to fix the type for trade uses and bring this capricious beauty under the law of descent.

Growers strive, too, to originate fine plants, keeping skillful gardeners at work selecting and hybridizing species, seeking to create new and improved varieties. And in California they have the advantage of a climate that gives vigor to the seed, that stimulates the growth of the plant, and anticipates the efforts of the seed-farmer to produce reliable seeds and improved types of vegetable and flower.

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THE NATIONAL GEOGRAPHIC MAGAZINE

OUR NATIONAL PARKS

BY L. F. SCHMECKEBIER

IN ELEVEN western States tracts of public land varying in extent from several hundred to over two million acres have been withdrawn from settlement and private exploitation and dedicated by act of Congress as national parks for the benefit and enjoyment of the people.

Within these great reserves may be found scenery and natural phenomena that are unequaled in their majesty and grandeur.

In some of them the traveler may select his method of transportation; he may proceed by coach, on horseback, or on foot; he may stop at the hotels or camps, or he may make his own camp in the solitude of the forest or in the midst of meadows gorgeous with the products of nature's garden.

In other parks the absence of roads compels him to travel on horseback and accompanied by a pack train—and after all this is the best way to enjoy thoroughly the beauties of the mountain and the forest. In all of the parks one is free to come and go as he will, subject only to regulations that look to the protection of the forest and the wild animals.

THE YELLOWSTONE

The oldest and largest of the parks is the Yellowstone, created by the act of Congress approved March 1, 1872. It has an area of 2,142,720 acres, mostly in Wyoming, but with narrow strips on the north and west in Montana and Idaho. The best-known features of Yellowstone Park are the geysers, the Mammoth Hot Springs, and the Great Falls and Grand Canyon of the Yellowstone River.

The geysers are located in three basins—the Norris Geyser Basin near the headwaters of Gibbon River, and the Upper and Lower Geyser basins along Firehole River. Even when the geysers are not in eruption the basins present scenes of weird and singular beauty.

Clouds of steam rise from countless vents; the gaunt trunks of trees, killed by the hot water and bleached to dazzling whiteness, stand specter-like around the edges of the basins; here and there emerald pools or a beautifully colored deposit is seen in sharp contrast to the white sinter which forms the floor.

Of the 84 geysers in the park no two are alike in their characteristics. The Constant Geyser, in the Norris Basin, sends forth graceful jets of water to a height of about 20 feet at intervals of one minute, while the Giant Geyser, in the Upper Geyser Basin, is in eruption at intervals of from five to seven days.

It is Old Faithful, however, which is most regular in its operations. In the 40 years that this geyser has been known to the white man it has never failed to eject its graceful column of water at intervals of 65 minutes.

Photo by U. S. Geological Survey

OLD FAITHFUL GEYSER: YELLOWSTONE PARK

"In the 40 years that this geyser has been known to the white man it has never failed to eject its graceful column of water at intervals of 65 minutes" (page 531)

Photo by W. S. Berry

WHITETAIL DEER IN ACTION: YELLOWSTONE NATIONAL PARK

Four miles from the northern entrance to the park are the Mammoth Hot Springs terraces, which have been built up by the travertine deposited by the hot waters. From below the glimmering terraces present the appearance of a mass of ice and snow. In places the slope is steep, as if a large portion of it had been torn away; at other points the descent is broken by series of terraces of varying height, the front of each terrace being delicately fluted or molded into the most exquisite tracery.

Impressive as are the terraces from below, the scene from the summit is even more varied and beautiful. To the east is the escarpment of Mount Evarts; to the northwest the crest of Electric Peak stands sentinel at the boundary of the park, while around and below are the brilliantly colored pools which form the outlets of the springs.

The Great Falls and the Grand Canyon of the Yellowstone River present a combination of color and rock sculpture unequaled in beauty and grandeur. For some distance below Yellowstone Lake the river flows peacefully through meadow and forest, but a half mile above the Upper Falls the banks converge and the waters are lashed into foam. At the upper fall the drop is 109 feet. Then follows a few hundred feet of turbulent water, and the stream leaps 308 feet to the bottom of the Grand Canyon, which, writes Kipling in his American Notes, is "one wild welter of color—crimson, emerald, cobalt, ochre, amber, honey splashed with port wine, snow-white, vermilion, lemon, and silver-gray in wide washes.

"The sides did not fall sheer, but were graven by time and water and air into monstrous heads of kings, dead chiefs, men, and women of the old time. So far below that no sound of its strife could reach us, the Yellowstone River ran—a finger-wide strip of jade green. The sunlight took those wondrous walls and gave fresh hues to those that nature had already laid there. Once I saw the dawn break over a lake in Rajputana and the sun set over the Oodey Sagar amid a circle of Holman Hunt hills. This time

Photo by U. S. Geological Survey

CRATER OF CASTLE GEYSER: YELLOWSTONE PARK

"Of the 84 geysers in the park, no two are alike in their characteristics. The Constant Geyser, in the Norris Basin, sends forth graceful jets of water to a height of about 20 feet at intervals of one minute, while the Giant Geyser, in the Upper Geyser Basin, is in eruption at intervals of from five to seven days" (page 531).

Photo by U. S. Geological Survey

LONE STAR GEYSER: YELLOWSTONE PARK

Photo by U. S. Geological Survey

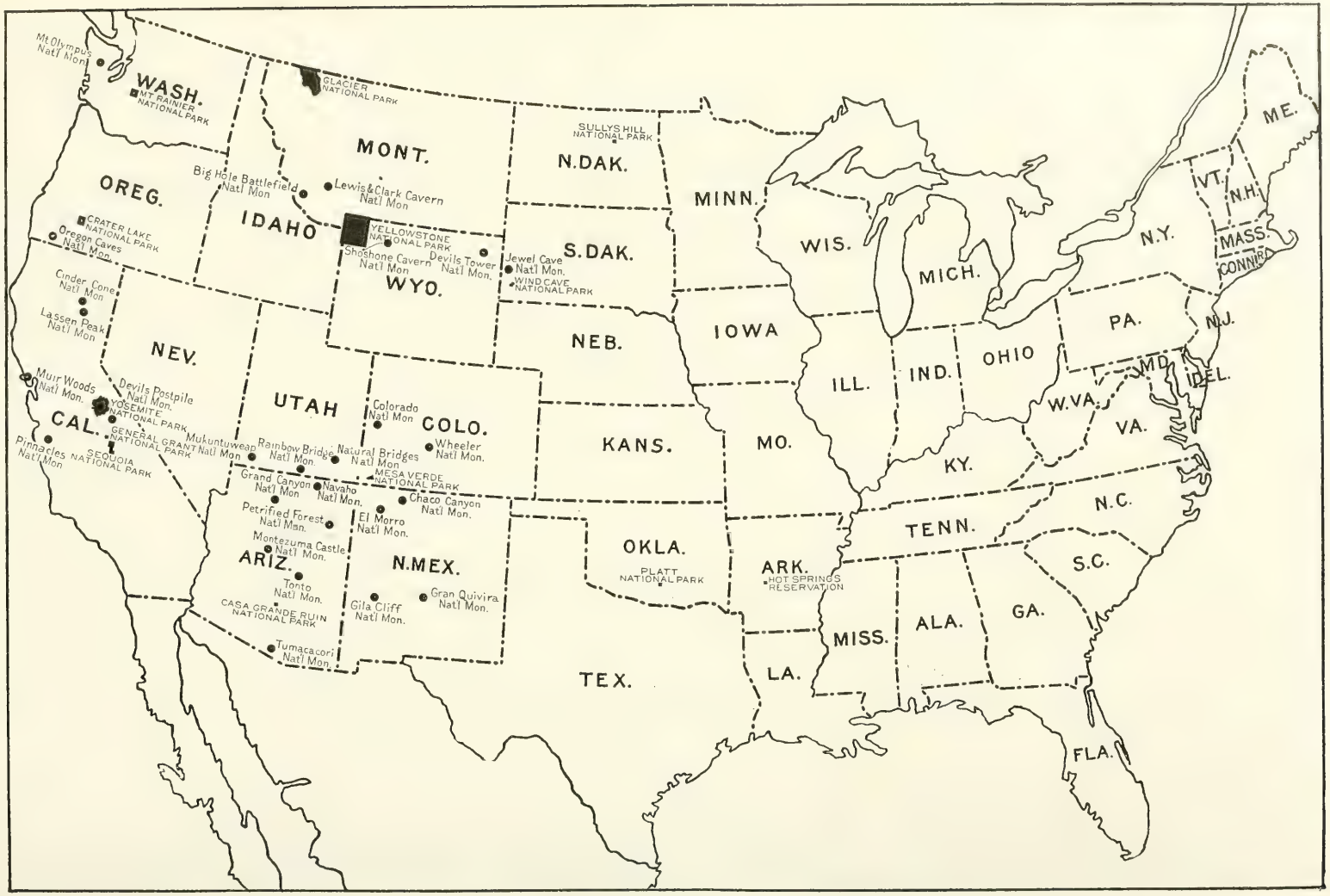
MINERVA TERRACE: MAMMOTH HOT SPRINGS, YELLOWSTONE NATIONAL PARK

"Four miles from the northern entrance to the park are the Mammoth Hot Springs terraces, which have been built up by the travertine deposited by the hot waters" (page 533)

Photo by U. S. Geological Survey

PULPIT TERRACE: MAMMOTH HOT SPRINGS, YELLOWSTONE PARK

"From below the glimmering terraces present the appearance of a mass of ice and snow. In places the slope is steep, as if a large portion of it had been torn away; at other points the descent is broken by a series of terraces of varying height, the front of each terrace being delicately fluted or molded into the most exquisite tracery" (page 533).



MAP SHOWING LOCATION OF NATIONAL MONUMENTS AND NATIONAL PARKS

Photo by W. S. Berry

MOUNTAIN SHEEP IN YELLOWSTONE NATIONAL PARK

I was watching both performances going on below me—upside down you understand—and the colors were real. The canyon was burning like Troy town; but it would burn forever, and, thank goodness, neither pen nor brush could ever portray its splendors adequately."

The tourist can see the great wonders of the Yellowstone in five and a half days. Twice that time is none too little for an adequate appreciation of the beauties of this wonderful region, because off the regular route are many charming bits of scenery that would be considered remarkable in a region not possessing so many other wonderful sights.

THE GLACIER NATIONAL PARK

Two hundred and sixty miles northwest of Yellowstone Park as the crow flies and 447 miles by the railroad is the newest of the nation's pleasure grounds, the Glacier National Park, created by the act of May 11, 1910. This park, which has an area of 915,000 acres, derives its name from the many glaciers which glisten in dazzling white far up on the steep slopes of the mountain. A fine road has been built from Belton, on the Great Northern Railway, to the foot of Lake McDonald, a distance of two miles. Beyond Lake McDonald the unbroken wilderness stretches to the Canadian border and beyond.

The trail winds through the solemn forests, redolent of pine and fir, along the shores of the clearest of lakes, by rollicking cascades and along the edge of precipices. Here are peaks whose sides have never been scaled and lakes whose shores have never been trod by human foot. From the summit of the continental divide one may see the lakes far below encompassed by precipice and forest, but no trail leads through the tangled woods, where the dense growth and the windfalls of countless storms conspire to keep the traveler from his goal.

In the entire area of this park there are at present only 199 miles of trail, but these enable the traveler to see some of the grandest of mountain scenery and get at least a glimpse of some of the 81 glaciers and 132 lakes that are shown on the government map.

From Lake McDonald one may make a number of trips, on horseback or on

Photo by Haynes

A PARK BEAR—"SILVER-TIP" GRIZZLY: YELLOWSTONE NATIONAL PARK

Photo by Haynes

PARK BUFFALO: YELLOWSTONE NATIONAL PARK

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SCENE IN THE GLACIER NATIONAL PARK

foot, in a day. One of these is to Avalanche Lake, a charming body of water, which is surrounded by great cliffs and into which the melting snow pours cascades, looking in the distance like threads of silver. Another interesting trip, affording fine views of lake, mountain, and forest, is to the west of Lake McDonald, to Trout Lake, situated in one of the most impressive of glacial cirques. Still another trip is over the steep slope of Edwards Mountain to Sperry Glacier, where a camp has been established for the accommodation of the traveler. One may continue from Sperry Glacier over Gunsight Pass, amidst the finest of mountain scenery, to Upper St. Marys Lake, and thence to Midvale on the railroad.

THE CRATER LAKE

On the summit of the Cascade Range, in southern Oregon, lies the Crater Lake National Park, established by the act approved May 22, 1902. In the center of this park, which has an area of 159,300 acres, lies Crater Lake, unsurpassed in the gorgeousness and grandeur of its scenery, unrivaled in its location on the summit of a mountain 7,000 feet above sea-level, and unparalleled in its geologic history.

The traveler who stands on the rocky rim of the lake and looks across its limpid waters is at a point where once the molten lava boiled

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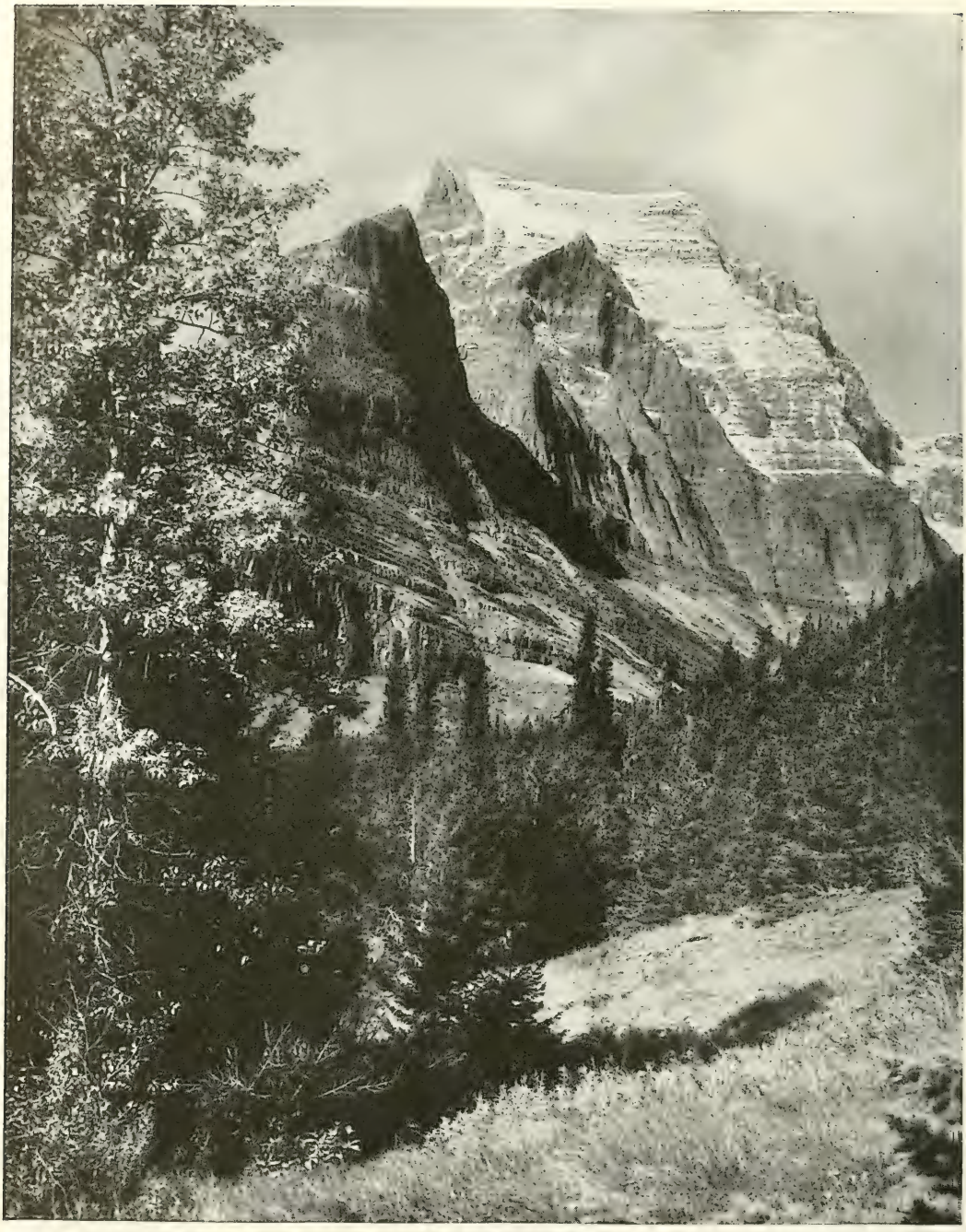
HEAD OF LAKE ST. MARY: GOING-TO-THE-SUN MOUNTAIN TO RIGHT FROM UPPER NARROWS: GLACIER NATIONAL PARK



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GOING-TO-THE-SUN MOUNTAIN: GLACIER NATIONAL PARK

and seethed in its efforts to find an outlet, for Crater Lake is all that remains of a great volcano that ages ago reared its lofty summit high above the crest of the Cascade Range.

This mountain in its prime rose to a height of over 14,000 feet above the sea. Mount Scott, which towers above Crater Lake on the east, was only a minor cone on its slope. The portion of the moun-

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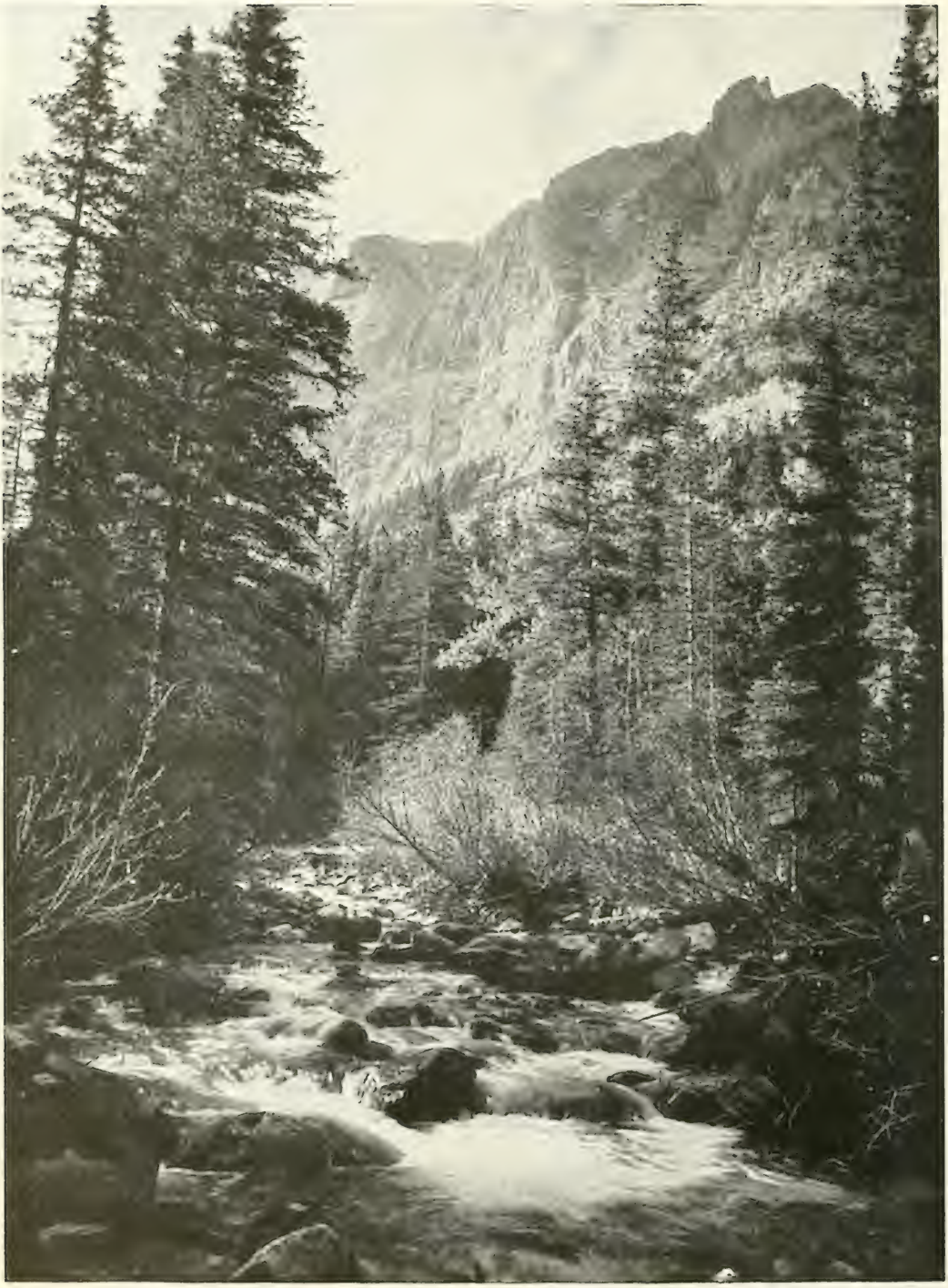
LOOKING SOUTH ALONG THE EAST SIDE OF THE GARDEN WALL, SHOWING A 2,000-FOOT WATERFALL: GLACIER NATIONAL PARK



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CANYON CREEK: GLACIER NATIONAL PARK

"In the entire area of this park there are at present only 199 miles of trail, but these enable the traveler to see some of the grandest mountain scenery and get at least a glimpse of some of the 81 glaciers and 132 lakes that are shown on the government map" (page 539).

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GUNSIGHT LAKE FROM JACKSON MOUNTAIN: GLACIER NATIONAL PARK

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CLIMBING THE BLACKFOOT GLACIER: GLACIER NATIONAL PARK

Photo by A. H. Barnes

NORTH SIDE OF RAINIER AS VIEWED FROM SPRAY PARK: ELEVATION, 6,000 FEET ABOVE SEA-LEVEL

See elsewhere in this number for article and photos of Mount Rainier by A. H. Barnes

tain that has been destroyed was equal in size to Mount Washington, in New Hampshire, and had a volume of 17 cubic miles.

From the crest of the rim surrounding the lake the traveler beholds 20 miles of unbroken cliffs, which range from 500 to nearly 2,000 feet in height. The clear waters of the lake reflect the vivid colors of the surrounding walls, and whether in the soft glow of early morning, in the glare of the noonday sun, or in the rosy hues of the dying day, the view is one of awe-inspiring grandeur and beauty. Near the western edge of the lake is Wizard Island, in the top of which is an extinct crater 100 feet deep and 500 feet in diameter.

Near the southern shore is a jagged rock 200 feet high, known as Phantom Ship. Viewed from a distance it resembles a great vessel, but it apparently disappears when the shadow strikes it—hence its name.

This lake is not the only attraction of the national park in which it is situated. The surrounding peaks afford opportunities for climbing, and the extended views from their summits offer an adequate recompense for the effort necessary to reach them.

THE MOUNT RAINIER NATIONAL PARK

The largest glacial system in North America radiating from a single peak is situated on Mount Rainier, in western Washington. The Mount Rainier National Park, which was established by the act of March 2, 1899, and has an area of 207,360 acres, includes the mass of this great mountain and all the approaches to it.

Of Mount Rainier that sage of the forest and the mountains, John Muir, says: "If in the making of the West Nature had what we call parks in mind—places for rest, inspiration, and prayers—this Rainier region must surely be one of them. In the center of it there is a lonely mountain capped with ice; from the ice-cap glaciers radiate in every direction, and young rivers from the glaciers; while its flanks, sweeping down in beautiful curves, are clad with forests and gardens and filled with birds and animals. Specimens of the best of Nature's treasures have been lovingly gathered here and arranged in simple symmetrical beauty within regular bounds."

From Puget Sound, 60 miles away, one gets superb views of this great mountain rising over 14,000 feet above the level of the sea. Now its snowy summit looms up sharp and severe against the eastern sky; now it is veiled in mist, like some giant priestess keeping vigil over the valley and plain; now it is garbed in the softest of violet-pink as it is illumined by the after-glow of the setting sun.

The traveler approaching Mount Rainier passes through areas in which the climate and the vegetation range from temperate to arctic. The lower valley is thickly mantled with fir, hemlock, and cedar, the undergrowth is dense, and the forest floor is covered with moss and a litter of fallen branches and decayed wood.

As the mountain is ascended the vegetation changes; at an altitude of 4,000 feet the forest cover consists of mountain hemlock, Alpine fir, and Alaska cedar.

Here in the very shadow of the snow-capped mass the valleys are literally carpeted with avalanche lilies, asters, anemones, rhododendrons, and other bright flowers (see pages 591 to 613).

As one goes higher the trees become smaller. They are gnarled and twisted, as if they had endeavored to escape the fury of the fierce blasts that sweep over the upper slopes. The trees dwindle to straggling bushes, and then the climber is on the bare rocks, polished and scarred by the masses of snow and ice that have swept over them. The last four miles to the summit is along the ridges between the glaciers or over the ice. The way is rough and steep, and is a dangerous one unless accompanied by a guide.

THE YOSEMITE

California boasts of three national parks—the Yosemite, the Sequoia, and the General Grant. As long ago as 1864 an act of Congress granted the Yosemite Valley and the Mariposa grove of big trees to the State of California for public

Photo by Asahel Curtis

FOREST OF FIR IN MOUNT RAINIER NATIONAL PARK

"In the center of it there is a lonely mountain capped with ice; from the ice-cap glaciers radiate in every direction, and young rivers from the glaciers; while its flanks, sweeping down in beautiful curves, are clad with forests and gardens and filled with birds and animals. Specimens of the best of nature's treasures have been lovingly gathered here and arranged in simple symmetrical beauty within regular bounds."—JOHN MUIR. See page 550.

Photo by George R. King

ON WAWONA ROAD, IN THE YOSEMITE NATIONAL PARK: EL CAPITAN ON LEFT

"The Yosemite Valley is about seven miles long and three-fourths of a mile wide. In the center of this valley is a level, parklike meadow, through which runs Merced River, while on either side the mountains rise steep and precipitous to a height of 4,000 feet above the floor of the

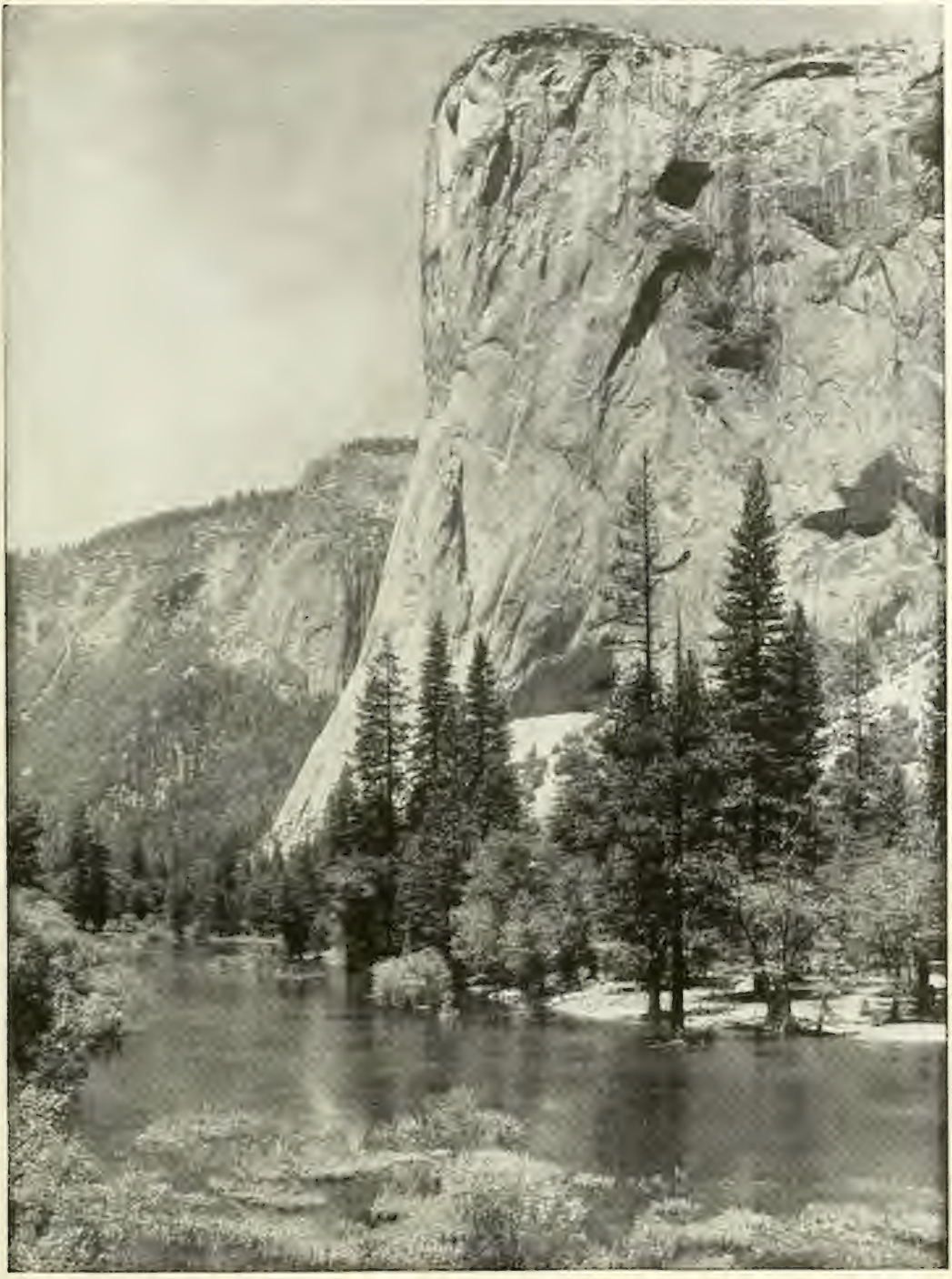


Photo by George R. King

THE WHITE GRANITE FACE OF EL CAPITAN: YOSEMITE NATIONAL PARK

"From the cliffs surrounding the valley the scene is one of remarkable inspiration and beauty. At the foot of the traveler lies the valley floor, the green trees and meadows and the winding river giving the effect of a rich velvet carpet, over which a line of silver has been drawn; here and there one gets glimpses of the foaming white waters, hurling themselves to the valley below; on both sides of the valley rise the great walls of rock, sculptured by the elements into various fantastic shapes and figures" (page 557).

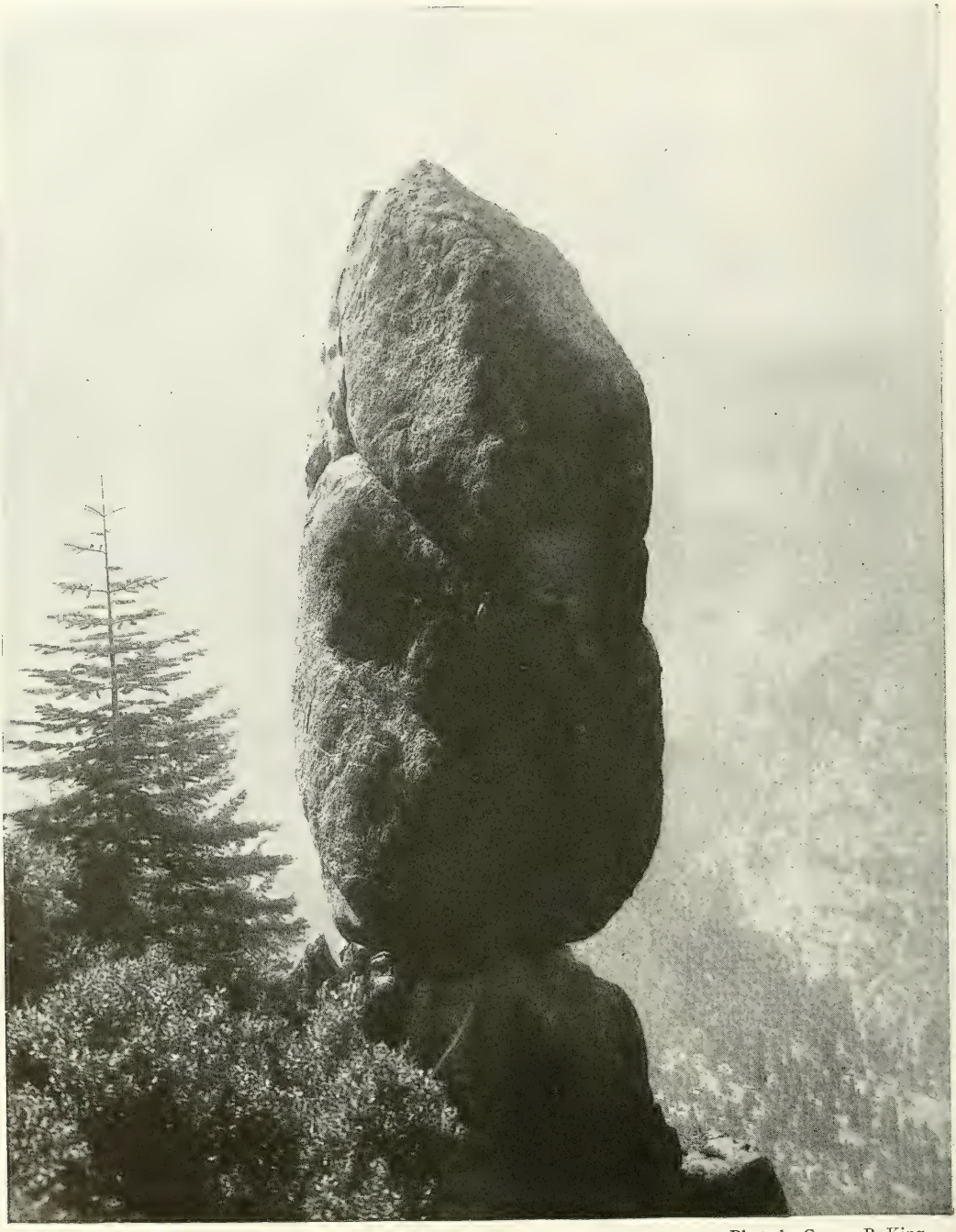


Photo by George R. King

AGASSIZ COLUMN: YOSEMITE NATIONAL PARK

Photo by George R. King

CATHEDRAL SPIRES: YOSEMITE NATIONAL PARK

Photo by J. T. Boysen

GRIZZLY GIANT MARIPOSA: BIG TREE GROVE, YOSEMITE NATIONAL PARK

Note the buckboard and team of horses

use and recreation. By the act of October 1, 1890, the portion of Yosemite Park outside of the Yosemite Valley and the Mariposa big-tree grove was set apart as a public reservation, the boundaries being changed by the act of February 7, 1905. The Legislature of California, by the act approved March 3, 1905, receded the Yosemite Valley and the Mariposa big-tree grove to the United States, and the joint resolution of Congress approved June 11, 1906, accepted the recession and fixed the boundaries of the park as they are at present, giving it an area of 719,622 acres.

The Yosemite Valley, which is the most frequently visited place, is about seven miles long and three-fourths of a mile wide. In the center of this valley is a level, parklike meadow, through which runs Merced River, while on either side the mountains rise steep and precipitous to a height of 4,000 feet above the floor of the valley.

Numerous streams drop from the edge of the cliff to the valley below. The first of these as the tourist enters the valley is the Bridal Veil Falls. A stream fully 30 feet wide falls first a distance of 600 feet, then rushes over a sloping pile of débris, and then drops perpendicularly 300 feet more. From the points from which it is generally viewed it seems to make but one plunge, and the general effect is that of a fall 900 feet high.

The great waterfall in this park, however, is the Yosemite Falls. This is a stream 35 feet wide, and in the spring and early summer, when the snow is melting upon the high Sierra, its roar can be heard all over the valley and the shock of the descent rattles the windows a mile away. This fall is conceded by all critics to be one of the most wonderful and beautiful cascades in the world. Its first fall is 1,430 feet sheer drop; then comes a series of cascades, partly

hidden, in which the fall is 675 feet, and finally a vertical drop of 320 feet.

From the cliffs surrounding the valley the scene is one of remarkable inspiration and beauty. At the foot of the traveler lies the valley floor, the green trees and meadows and the winding river giving the effect of a rich velvet carpet, over which a line of silver has been drawn; here and there one gets glimpses of the foaming white waters, hurling themselves to the valley below; on both sides of the valley rise the great walls of rock, sculptured by the elements into various fantastic shapes and figures. Beyond the valley is a wonderful region of mountain and forest, accessible only by pack train.

THE LARGEST TREES IN THE WORLD

The largest trees in the world are found in the Yosemite, the General Grant, and the Sequoia National parks. The Sequoia National Park, established by the act of September 25, 1890, is located in Tulare County and has an area of 161,597 acres. The General Grant Park, established by the act of October 1, 1890, is in Tulare and Fresno counties and has an area of 2,536 acres.

These trees grow to a height of over 300 feet and have a circumference of over 100 feet at the base, the bark sometimes exceeding 40 inches in thickness. The rings in their trunks show that many of them are over 3,000 years old. For a hundred feet or more they are clear of branches, then great limbs the thickness of large trees extend

Photo by J. T. Boysen

WAWONA TREE: MARIPOSA BIG TREE GROVE, YOSEMITE NATIONAL PARK

Photo by H. C. Best

YOSEMITE FALLS, IN THE YOSEMITE VALLEY: YOSEMITE NATIONAL PARK

"This is a stream 35 feet wide, and in the spring and early summer, when the snow is melting upon the high Sierra, its roar can be heard all over the valley and the shock of the descent rattles the windows a mile away. This fall is conceded by all critics to be one of the most wonderful and beautiful cascades in the world. Its first fall is 1,430 feet sheer drop; then comes a series of cascades, partly hidden, in which the fall is 675 feet, and finally a vertical drop of 320 feet" (page 556).

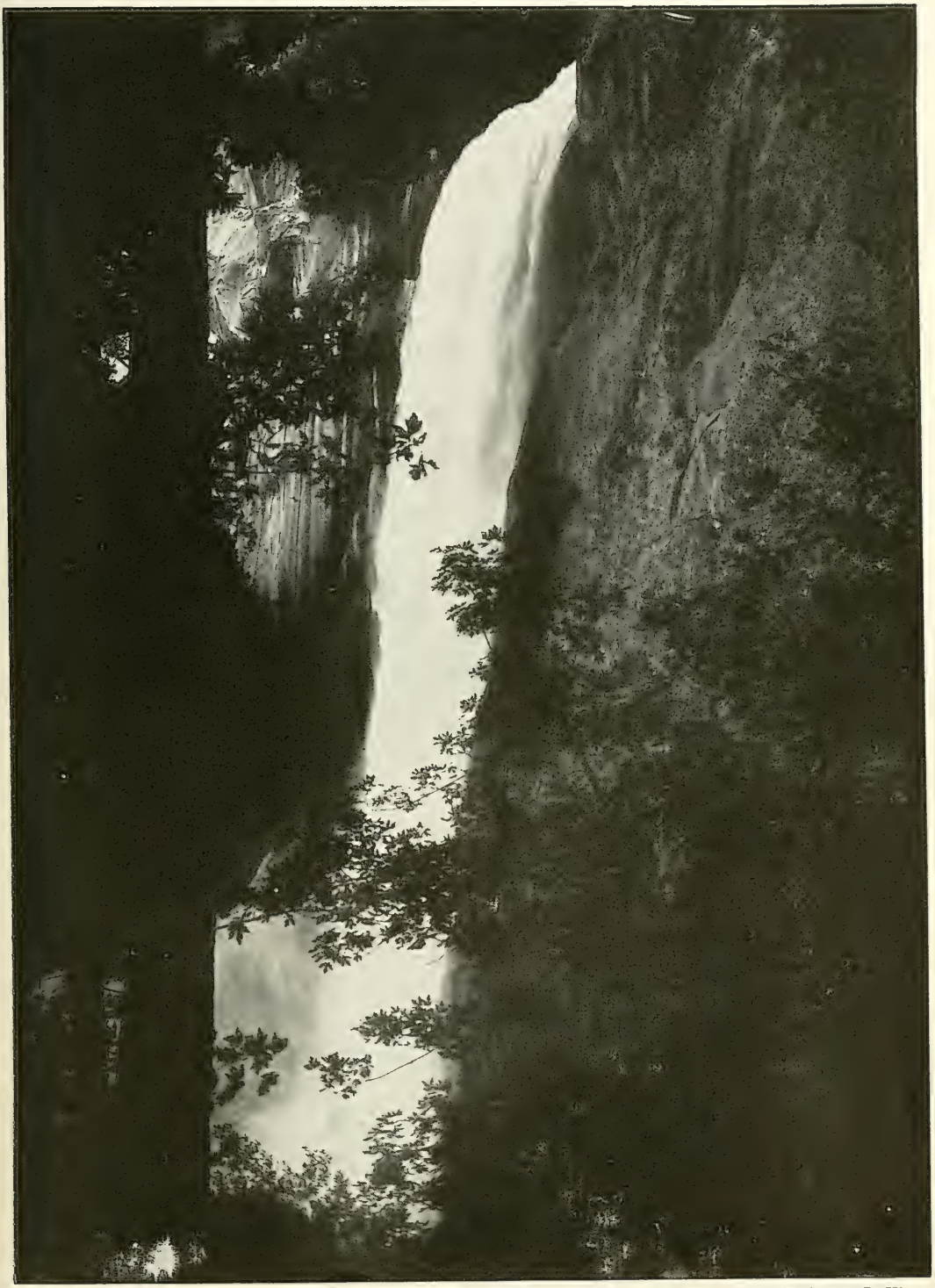


Photo by George R. King

VERNAL FALL FROM MIST TRAIL: YOSEMITE NATIONAL PARK

Photo by Southern Pacific R. R. Co.

THE PARKER GROUP, IN THE GIANT FOREST: SEQUOIA NATIONAL PARK: NOTE THE TWO MEN STANDING BESIDE THE HORSE

Photo by Southern Pacific R. R. Co.

A FALLEN MONARCH, IN THE MARIPOSA BIG TREE GROVE: YOSEMITE NATIONAL PARK

Photo by Southern Pacific R. R. Co.

IN THE MARIPOSA BIG TREE GROVE: YOSEMITE NATIONAL PARK, CALIFORNIA

above the tops of the pines of the surrounding forest.

Their branches are not swayed nor are their trunks bent by the fiercest wind; they stand calm, silent, and majestic—hoary hermits of the forest—unmoved and unaffected by the puny actions of the youthful world surrounding them.

In the Yosemite Park the principal groves are the Tuolumne, the Merced, and Mariposa. In the last-named grove the road extends through the base of one of the trees, and a coach and four are regularly driven through this tunnel without danger or discomfort to the traveler.

In the General Grant Park there is only one grove, but it is in the Sequoia Park that these trees are found in the greatest number. There are 12 groves in this park that contain altogether about 12,000 sequoia greater than 10 feet in diameter. In the Giant Forest Grove there are 5,000 such trees, in the Muir Grove 3,000, and in the Garfield Grove 2,500.

A bill was introduced in the last Congress providing for enlarging Sequoia Park so that it would extend to the northern edge of the watershed of Kings River. In this area the general topography is similar to that in Yosemite. The streams cut deep gorges through the sierra, great masses of rock stand sentinel-like on the edges of the narrow valleys, and everywhere are forests of pine, fir, and cedar, and wild flowers, ferns, and mosses of superb beauty. The boundary proposed is a natural one, being the ridge line of numerous mountain chains.

Practically all the new territory that would be acquired is public land of little value commercially and of great value for park purposes. Its natural beauties are great and varied; it forms a natural game preserve, and within its borders are some of the finest trout streams in world.

THE MESA VERDE NATIONAL PARK

In southwestern Colorado the dwellings of the extinct race of cliff-dwellers are preserved in the Mesa Verde National Park, established by the act of June 29, 1906. In the 42,376 acres included in this park there are about 400 cliff-houses of varying size. The period at which these cliff dwellings were occupied and the cause of the depopulation are unknown, but there is no doubt that the buildings are prehistoric.

Unfortunately, much of the valuable and interesting pottery and other relics were carried off from these ruins before the park was established. Since the creation of the park three of the greatest of the ruins—Cliff Palace, Spruce Tree House, and Balcony House—have been repaired and the rubbish of centuries has been removed. The tottering walls have been braced and reinforced with steel and concrete, the underground chambers have been cleaned out and repaired, and drains have been built in order to carry off the storm waters and prevent further erosion.

The most impressive ruin in the park is Cliff Palace, a structure about 300 feet in length, built under the roof rock of an enormous cave. This ruin contains 146 living rooms, including numerous large chambers used for assembly rooms for the purpose of worship or council.

Spruce Tree House is the next largest ruin. The curved front wall of this structure measures 218 feet and the ruin is 89 feet deep. The ruin contains 114 secular rooms, eight subterranean kivas, and a roofless kiva, sometimes called a warrior's room.

Many of the dwelling chambers are three stories high, several filling the interval from the floor to the roof of the cave. It is estimated that the population of this ruin was 350 persons. Balcony House is a smaller ruin, containing about 25 rooms.

Little is known of the vanished race that dwelt in these inaccessible canyons. That they were small-sized is shown by the dwarf-like mummies that have been found in their dwellings. They evidently lived in communities for mutual protection, access to their dwellings being obtained by following narrow trails along the cliffs or by small tunnels cut through the rock.

Photo by George R. King

THE SUMMIT OF SENTINEL DOME: YOSEMITE NATIONAL PARK

Photo by George R. King

WILD AZALEA IN THE YOSEMITE NATIONAL PARK

Photo by Southern Pacific R. R. Co.

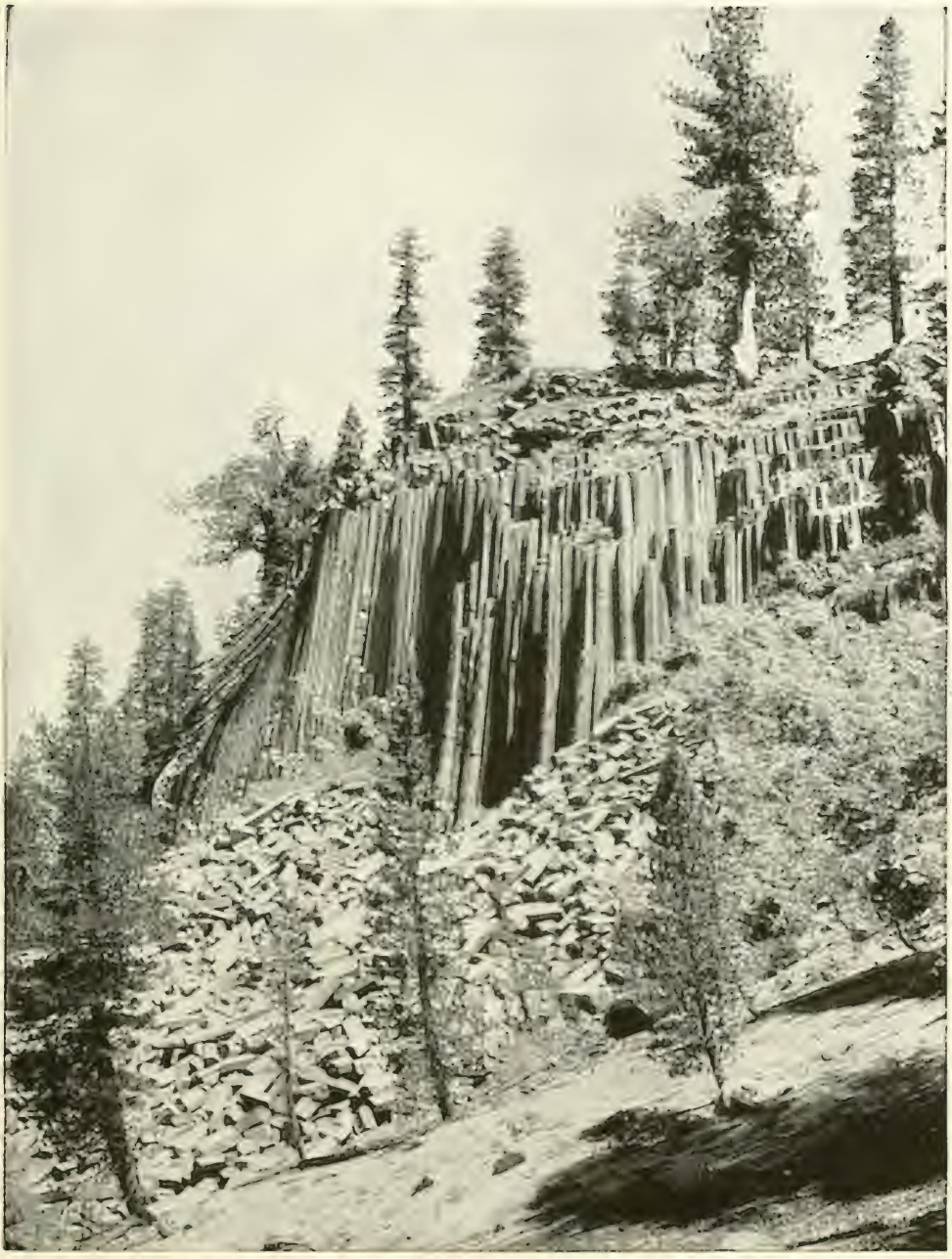
"FOREST QUEEN": MARIPOSA BIG TREE GROVE, YOSEMITE NATIONAL PARK, CALIFORNIA

Photo by Southern Pacific R. R. Co.

"GENERAL SHERMAN TREE," IN THE GIANT FOREST, SEQUOIA NATIONAL PARK, CALIFORNIA
Note the two human figures on each side of the tree

THE DEVIL'S POST PILE: NATIONAL MONUMENT, IN THE SIERRA NATIONAL FOREST

The Devil's Post Pile is a remarkable example of basalt columns, which are fairly regular and ordinarily hexagonal in cross sections, although pentagonal and other shapes are not uncommon. The average diameter is about two feet. The columns, or so-called posts, lie in the pile at all



END VIEW OF THE DEVIL'S POST PILE: A WONDERFUL CLIFF OF COLUMNAR BASALT

It is on this side that the greatest free lengths can be observed. Each winter's frosts throw down portions of the outer columns, and, from the size of the pile of fragments at the base, this process must have been going on for centuries. How far the formation extends below the pile of fragments is unknown, but it probably extends a considerable distance. A measurement by the writer (W. L. Huber) showed a maximum vertical length of 50 feet standing free above the pile of fragments. On the top of the pile the ends of a number of the posts are exposed and show unmistakable evidence of glaciation. Most of the post pile and much of the surrounding country are covered with a layer of pumice. This is apparently the product of a volcanic eruption which occurred after the glaciers had receded. Photo and note by W. L. Huber.

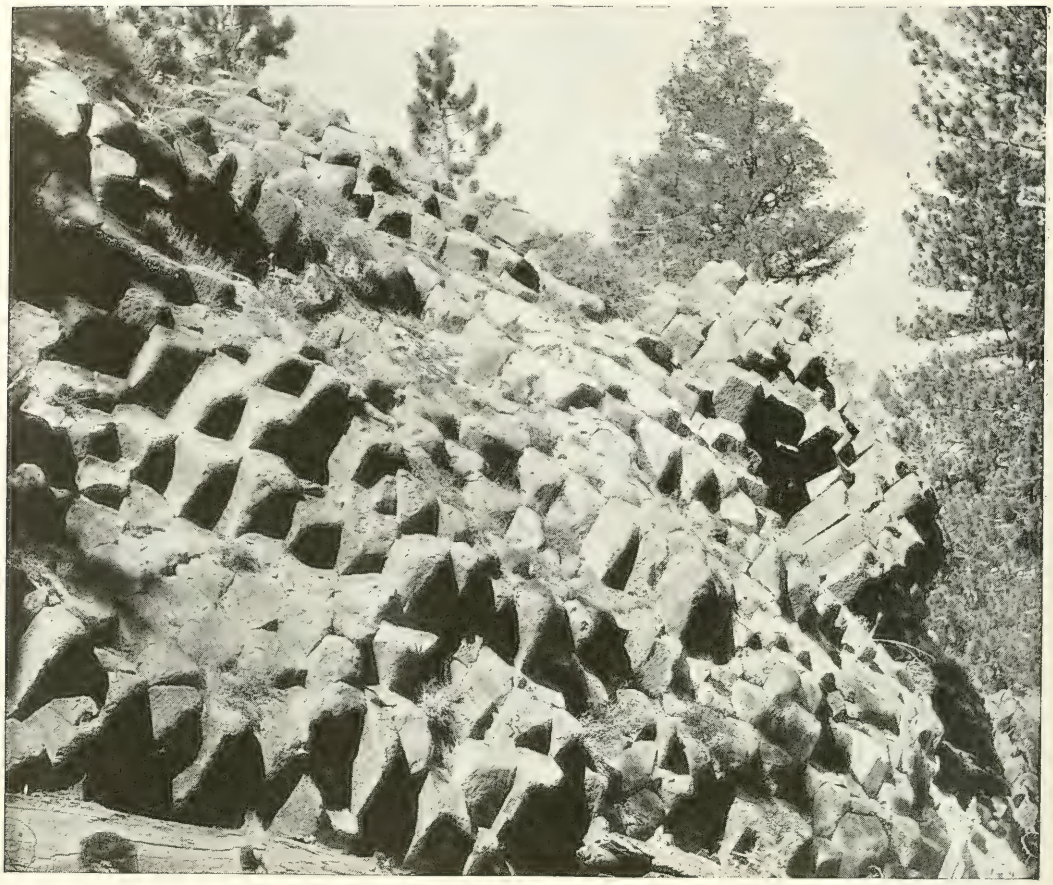


Photo by W. L. Huber

AN END VIEW OF THE DEVIL'S POST PILE

These ruins are situated about 25 miles southwest of Mancos, Colorado. For a distance of 18 miles the government has constructed a wagon road, but the remainder of the distance must be traveled on horseback.

WIND CAVE NATIONAL PARK

Wind Cave National Park, in South Dakota, created by the act of January 9, 1903, is situated 12 miles east of Hot Springs, South Dakota, and has an area of 10,522 acres. Its one attraction is a limestone cave of remarkable beauty, containing many fantastic and peculiar formations. Sullys Hill National Park, in North Dakota, and Platt National Park, in Oklahoma, are of considerable local interest, but present no striking features to make them of general importance. Sullys Hill Park was created by the act of April 27, 1904, and has an area of 780 acres; Platt National Park was created by the acts of July 1, 1902, and April 21, 1904. It has an area of 848 acres.

THE HOT SPRINGS OF ARKANSAS

In the wooded hills of central Arkansas are the hot springs of Arkansas, on a government reservation which is not called a national park and which does not serve exactly the same purpose as the other parks, but whose importance is so great that it should be included in any discussion of the park system.

While the parks are essentially recreation grounds and serve as health restorers only in so far as they give opportunities for outdoor life, the hot springs of Arkansas have been held by the Federal government solely by reason

Photo by W. L. Huber

THE DEVIL'S POST PILE, SHOWING REGULARITY OF FORM OF COLUMNS

of the value of the hot waters as remedial agents. The waters of these springs, which are highly radio-active, are administered internally and by immersion through the form of baths.

The attractions of this reservation are the great therapeutic value of the water, the fine climate, and beautiful country in the neighborhood. Overworked business and professional men and all who need rest and recuperation find here forms of recreation that have a powerful influence in the restoration of health and strength.

By the act of April 20, 1832, Congress provided that four sections of land in the Territory of Arkansas, including the springs, a total of 2,560 acres, should be reserved from sale or entry in order that the waters of the springs might be preserved in perpetuity for the benefit of the sick.

When the State of Arkansas was created the Federal government still retained the ownership of the four sections, but did not reserve the jurisdiction. By later acts the size of the reservation was reduced to 911 acres, the present area.

All of the springs are on the reservation, but there has grown up adjacent to it the city of Hot Springs, over which the government has no jurisdiction or control, and in which the conditions have been such that many patients returned home dissatisfied. Through the coöperation of the government, the bath-house lessees, and public-spirited citizens, the conditions that caused so much adverse comment have largely passed away.

Under the supervision of a medical director appointed by the government, the sanitary conditions in the bath-houses have been materially improved. Some of the houses have been extensively remodeled and others have been torn down

Photo by George R. King

SCENE IN THE PETRIFIED FOREST OF ARIZONA, ONE OF OUR 28 NATIONAL MONUMENTS (SEE PAGE 575)

The Petrified Forest in Arizona contains a large quantity of petrified trees, none of which stand erect in place, as do many of the petrified trees in the Yellowstone National Park. The most prominent specimen is this great trunk, which forms a bridge across a canyon 45 feet in width

Photo by George R. King

THE GREAT LOG IN BLUE FOREST, IN THE FOSSIL FOREST OF ARIZONA

Photo by George R. King

ANOTHER VIEW IN THE FOSSIL FOREST OF ARIZONA, WHICH IS NOW A NATIONAL MONUMENT (SEE PAGE 577)

to make place for new ones. Two bath-houses, equal if not superior to any in the world, have recently been opened, and one other bath-house is under construction; two more are being extensively remodeled.

The government is at present doing everything in its power to develop those environments which aid in the restoration of health and to destroy those which are deleterious. The wonderful results effected by these waters bid fair to make the Hot Springs of Arkansas one of the world's great health resorts.

THOUSANDS OF VISITORS

All the national parks described above are under the administration and control of the Secretary of the Interior. Troops of cavalry patrol the Yellowstone, the Sequoia, the General Grant, and the Yosemite parks. The commanding officer, who is the acting superintendent, reports to the Secretary of the Interior on matters of civil administration and to the Secretary of War on matters of military routine. In the Yellowstone Park there is a still further division of authority by the fact that all road construction, bridge building, and road sprinkling are under the supervision of the Engineer Corps of the Army. In the other parks all the employees are appointed from civil life and report directly to the Secretary of the Interior.

The number of visitors to the parks, not including the Hot Springs reservation, has increased from 30,000 in 1906 to 93,000 in 1911, and the growth of the park work has been such that the small force in the office of the Secretary of the Interior is not deemed sufficient to cope with the increasing number of problems presented, and bills have been introduced in the Senate and House of Representatives for the creation of a bureau of national parks. The creation of such a bureau has been urged by Secretary of the Interior Walter L. Fisher in his annual report for 1911, and by President Taft. The latter, in a special message, February 2, 1912, referred to the parks as follows:

"I earnestly recommend the establishment of a bureau of national parks. Such legislation is essential to the proper management of those wondrous manifestations of nature, so startling and so beautiful that every one recognizes the obligations of the government to preserve them for the edification and recreation of the people. The Yellowstone Park, the Yosemite, the Grand Canyon of the Colorado, the Glacier National Park, and the Mount Rainier National Park, and others furnish appropriate instances.

"In only one case have we made anything like adequate preparation for the use of a park by the public. That case is the Yellowstone National Park. Every consideration of patriotism and the love of nature and of beauty and of art requires us to expend money enough to bring all these natural wonders within easy reach of our people. The first step in that direction is the establishment of a responsible bureau which shall take upon itself the burden of supervising the parks and of making recommendations as to the best method of improving their accessibility and usefulness."

OUR NATIONAL MONUMENTS

In addition to the national parks, there are 28 national monuments that have been created by executive proclamation, in accordance with the provisions of the act of June 8, 1906, which provides that national monuments may be created by the President to include landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the government of the United States. The act also provides that private lands may be relinquished to the United States, and that the Secretaries of the Interior, Agriculture, and War may make regulations governing the examination and excavation of ruins and the collection of objects of antiquity.

While the act provides for fine or imprisonment for injury to any of the ruins or natural objects within the boundaries of these monuments, Congress has never made an appropriation for supervision and protection; consequently much difficulty has been experienced in protecting these monuments

Photo by Pen-Dike Studio

CLIFF PALACE, LOOKING SOUTH: IN THE MESA VERDE NATIONAL PARK

"In southwestern Colorado the dwellings of the extinct race of cliff-dwellers are preserved in the Mesa Verde National Park, established by the act of June 29, 1906. In the 42,376 acres included in this park there are about 400 cliff-houses of varying size. The period at which these cliff dwellings were occupied and the cause of the depopulation are unknown, but there is no doubt that the buildings are prehistoric. The most impressive ruin in the park is Cliff Palace, a structure about 300 feet in length, built under the roof rock of an enormous cave. This ruin contains [illegible] for the purpose of worship or council" (see page 563)

from vandalism, unauthorized exploration, and spoliation. For this reason 10 of the monuments that are situated within national forests have been placed under the supervision of the Secretary of Agriculture, one under the Secretary of War, and the remaining 17 under the direction of the Secretary of the Interior.

Of the national monuments under the administration of the Secretary of the Interior the most striking are the Natural Bridges and Rainbow Bridge in Utah, El Morro in New Mexico, the Muir Woods in California, and the Petrified Forest in Arizona.

The Natural Bridges Monument, which is located in southwestern Utah, includes the three largest natural bridges that have been discovered. The Augusta Natural Bridge, the largest of the three, is a splendid arch of solid sandstone, measuring 335 feet from wall to wall and having below it a clear opening of 357 feet. It is more than three times as high and has twice the span of the celebrated natural bridge in Virginia; it would overspan the Capitol at Washington and clear the top of the dome by 51 feet.

The Rainbow Bridge is near the southern boundary of Utah, and is unique in that it not only forms a symmetrical arch on its under side, but presents also a curved surface above, and this resembles in shape a rainbow. It is 309 feet above the surface of the water and has a span of 278 feet.

Illustrations and full descriptions of these bridges have been published in recent numbers of this Magazine.*

El Morro is an enormous sandstone rock, in western New Mexico, that has been eroded in such fantastic forms as to give it the appearance of a great castle; hence the origin of its Spanish name. A small spring of water found existing at the rock made it a convenient camping place for the Spanish explorers of the 17th and 18th centuries, who carved on its face many inscriptions that are of great importance to the early history of the southwest. As there has heretofore been no local custodian, the rock is exposed to vandalism and the inscriptions are threatened with destruction by thoughtless visitors.

The Muir Woods National Monument is situated near the city of San Francisco and includes one of the most noted redwood groves in the State of California. The tract contains many trees more than 300 feet high, with a diameter of 18 feet or more at the butt. It was presented to the United States by William Kent.

The Petrified Forest in Arizona contains a large quantity of petrified trees, none of which stand erect in place as do many of the petrified trees in the Yellowstone National Park. The most prominent specimen is a great trunk, which forms a bridge across a canyon 45 feet in width (see page 572).

The other national monuments under the supervision of the Secretary of the Interior are as follows: The Devils Tower, a landmark in Wyoming; Montezuma Castle, Tumacacori, Chaco Canyon, and Gran Quivira in New Mexico; and Navajo in Arizona, prehistoric or Spanish ruins; Pinnacles in California, a group of spirelike formations underlain by caves; Mukuntuweap in Utah, a peculiar and beautiful gorge; Shoshone Cavern in Wyoming and Lewis and Clark Cavern in Montana, limestone caves of great beauty; Sitka in Alaska, an area containing some of the finest totem poles known; Colorado in western Colorado, an area of eroded monoliths similar to the well-known Garden of the Gods near Colorado Springs.

The national monuments administered by the Secretary of Agriculture are as follows: Lassen Peak and Cinder Cone in California, volcanic areas of great scientific interest; Gila Cliff Dwellings in New Mexico and Tonto in Arizona, prehistoric ruins; Jewel Cave in South Dakota and Oregon Caves in Oregon, limestone caverns of considerable extent; Mount Olympus in Washington, the summer range and breeding ground of the Olympic elk; Wheeler in Colorado* and Devils Post Pile in California,

*Described in the NATIONAL GEOGRAPHIC MAGAZINE, November, 1911, "The Great Rainbow Natural Bridge," by Joseph E. Pogue.

*See NATIONAL GEOGRAPHIC MAGAZINE, September, 1909, "The Wheeler National Monument."

Photo by George R. King

MOUNT SHASTA

"At the south, and well beyond the Oregon-California border, rises Mount Shasta, where the Cascades and the Sierras unite, guardian monarch to the northward as well as over a vast California domain"

areas containing peculiar rock formations; the Grand Canyon in Arizona, the largest and most impressive gorge in the world. Several bills have been introduced in Congress to make a national park of the Grand Canyon, but none of them has become law.

The Big Hole Battlefield National Monument in Montana, which is under the supervision of the War Department, includes an area surrounding a stone monument erected in memory of the men killed at the battle of the Big Hole during the Nez Percez Indian War of 1877.

SCENES AMONG THE HIGH CASCADES IN CENTRAL OREGON

By Ira A. Williams, of the Iowa State College

A GLANCE at any map of Oregon will recall the general arrangement of its surface features. The State is separated into two major provinces by the main axis of the Cascade Range, which extends in an almost due north-south direction from the Columbia River to the California boundary.

This "backbone" is marked by a succession of prominent mountain peaks, with snow-capped Mount Hood, at 11,225 feet, standing sentinel at the northern end of the series. At the south, and well beyond the Oregon - California border, rises Mount Shasta, where the Cascades and the Sierras unite, guardian monarch to the northward as well as over a vast California domain.

Between these termini the broken crest-line of the range consists of successive volcanic peaks, interspersed with more or less level spaces, due either to expansive mountain parks and meadows or to broad, barren, lava-covered areas. The whole range has been largely built by the eruption and outspreading of volcanic materials, and every peak that today appears along its picturesque sky-line marks the site of a former opening from which the materials of construction issued (see map on page 626).

Chief among the prominent points of the range, in its 250-mile stretch across Oregon, are Mount Jefferson, with an altitude of 10,350 feet; the Three Sisters peaks, each approximately 10,250 feet high; Diamond Peak, 8,250 feet; Mount Thielsen, 9,250 feet in height; and, at the south end of the range, Mount Pitt, which rises 9,760 feet above the sea. Mount Mazama should also be mentioned. It stands next to Mount Pitt, at the south, and its crater is occupied by the celebrated Crater Lake.

All of these and scores of others are the broken remnants of once active volcanoes. Of those mentioned, the five highest are snow-mantled and known to bear one or more living glaciers on their slopes.

It is an observation of considerable interest that, south of the Columbia, no river has yet managed to break through this vast barrier, and for many portions of the summit of the range but poor surface drainage is provided. Barrier lakes, formed through interference with former drainage-ways by volcanic processes and occasionally by glacial action, are therefore plentifully distributed along the higher slopes of the range across the State.

Few of the many prominent peaks of the high Cascades in Oregon have been fully explored. With the exception of Mounts Hood and Mazama, which have been rendered accessible through both Federal and private enterprise, the other conspicuous peaks of the range can be reached only by expeditions organized for the purpose. Rarely are they visited by the individual.

While portions have been mapped by the government topographers and members of the forest service, perhaps the most signal results have been accomplished among the less accessible of the glacier peaks by a mountain - climbing

organization, the Mazama Club of Portland. It is an outing club, whose advent dates back to 1894, when its formation was effected on the summit of Mount Hood. Similar in purpose to its sister organizations, the Sierra Club of California and the Alpine Club of Canada, its principal work is the exploration of and acquisition of knowledge concerning the high mountains of the north Pacific coast.

The word Mazama is adapted from "mazame," which is popularly said to refer to the mountain goat* (*Haplocerus montanus*) indigenous to the high cordillera. The aims of the club and the conditions of membership may be best stated by reference to its by-laws:

"The objects of this organization shall be the exploration of snow peaks and other mountains, especially of the Pacific Northwest; the collection of scientific knowledge and other data concerning the same; the encouragement of annual expeditions with the above objects in view; the preservation of the forests and other features of mountain scenery, as far as possible, in their natural beauty; and the dissemination of knowledge concerning the beauty and grandeur of the mountain scenery of the Pacific Northwest.

"Any person who has climbed to the summit of a perpetual snow peak, on the sides of which there is at least one living glacier, and to the top of which a person cannot ride, horseback or otherwise, shall be eligible to active or life membership."

The Mazamas claim credit for having successfully ascended at least 20 of the highest mountains of Washington, Oregon, and California. Among the number are included several first ascents. The photographs accompanying this paper were taken during the 17th annual outing of the club on and in the vicinity of the Three Sisters peaks, in central Oregon.

The Three Sisters region is approached most readily by the Eugene-Prineville trail, the long-established highway across the range between Eugene, a point in the Willamette Valley on the main line of the Southern Pacific Railway, and Prineville, in the upper Deschutes Valley east of the divide. From Eugene this trail ascends the McKenzie River for 70 miles. After leaving this stream near Belknap Springs it climbs in an additional 15 miles to an elevation of about 6,000 feet, at the summit of the range.

The McKenzie River is the largest of the headwaters of the great Willamette, and all of its upper course is through the heavy untouched forests of firs, cedars, pine, and hemlocks within the Federal forest reserve.

From a point in Lake Valley some 10 miles short of the divide, styled "Frog Camp," a horse trail leads a few miles southeastward across a barren lava flow and White Branch Creek to the timberline, at 7,750 feet, and to within about three miles of the nearest member of the group, Middle Sister.

Long ere this point has been reached, however, thrilling glimpses of the snow-mantled Sisters may be caught through opening vistas in the forest screen, but it is only with the forest largely behind that the individual peaks rise in their real glory, aproned in green and gleaming snow-limned against the eastern sky.

More pleasant and satisfactory camp sites need not be sought than are available within the fringing timber border. Here the predominating lodge-pole pines and subalpine firs contribute an abundance of fuel, and the innumerable ice-cold streams originating in the perennial snows above furnish a second all-essential element of physical comfort. Thoroughly watered and protected from the agents that threaten removal, the forest mold where exposed to sunlight is usually carpeted with a sod of green. As the snows of winter depart the green is early decorated with an exquisite sprinkling of crimson "painted hats," purple violets, and just a sufficient perspective of unassuming buttercup yellow to gratify, in its setting, even the more fastidious of esthetic senses.

Hundreds of mountain streams of all dimensions make their way from the dissolving snows down the lower slopes, at

*As a matter of fact "mazame" refers to the prong-horn antelope of the plains, *Antilocapra americana*.

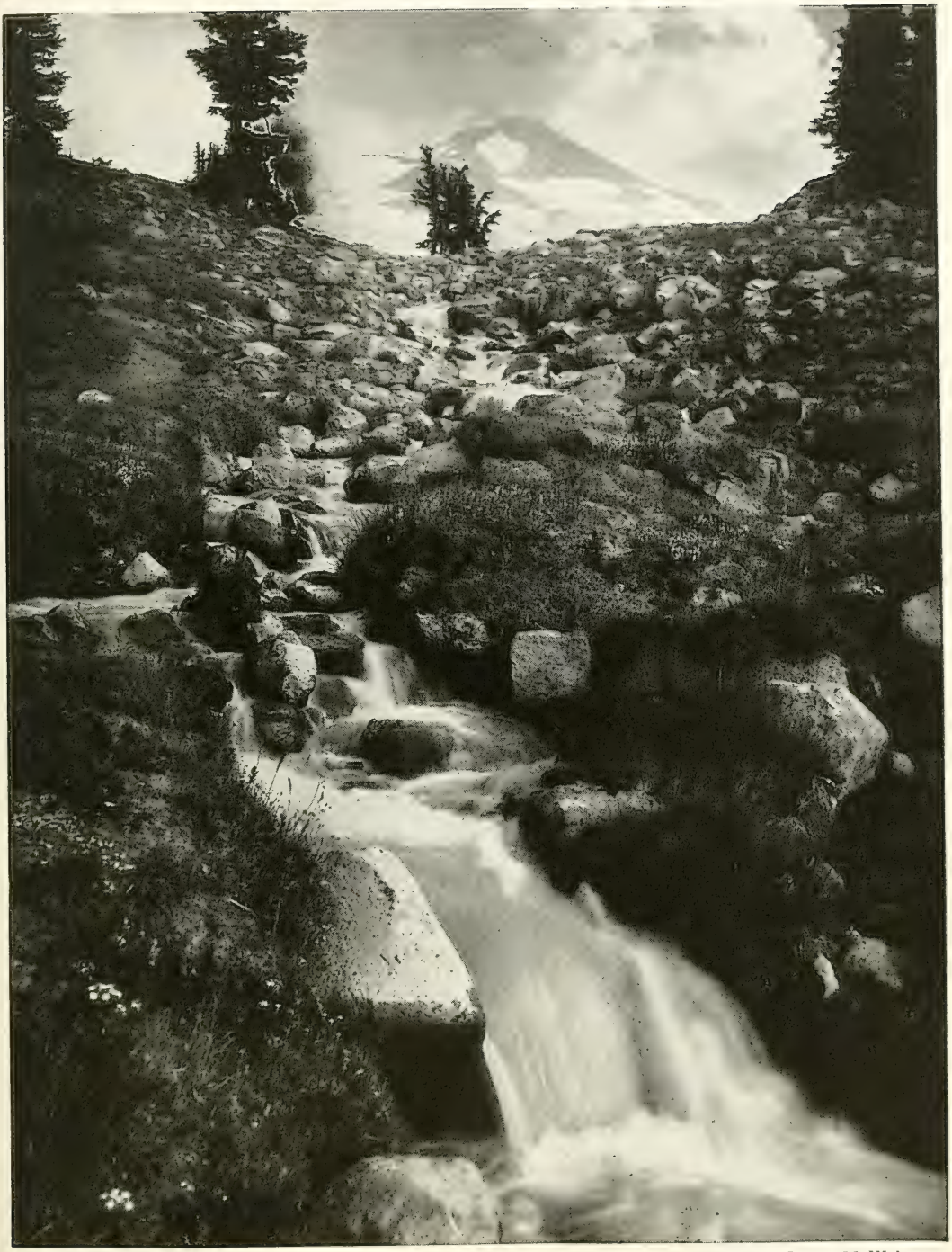


Photo by George M. Weister

A GLACIAL TORRENT FROM MIDDLE SISTER: COLLIER GLACIER AT LEFT, RENFREW AT RIGHT

White Branch Creek runs white with glacial sediment in the late day and early night, but is clear in the morning and forenoon. Note that the flowers of springtime are in blossom here in August. "Hundreds of mountain streams of all dimensions make their way from the dissolving snows, at times whipped into foaming turbulence as they dash over stretches of steep stony bed."

Photo by George M. Weister

SNOW-BALLING IN AUGUST: SNOW FIELD OF RENFREW GLACIER

"Emerging promontories of towering proportions, and displaying conspicuous structural peculiarities, are also objects of interest"

times whipped into foaming turbulence as they dash over stretches of steep stony bed, and again placidly winding a sinuous course through level reaches of grassy meadow.

Many of them come from the tips of melting glaciers. The latter in their forward movement pulverize to a "flour" portions of the rock surfaces over which they flow. As a result the streams issue surcharged with fine sediment, which gives to them a strong whitish or milky appearance.

In the smallest streams this milkiness is most apparent late in the day, while during the early morning and forenoon the water runs perfectly clear, a phenomenon due no doubt to the influence of the heat of the day on the volume of the flow and therefore on the stream's ability to carry the sediment given to it.

The Sisters peaks occupy the apices of a flatly triangular area, the shortest distance between angles being about 5 miles, from North to South Sister. Middle Sister stands intermediate and but slightly out of line to the west.

These three points mark the roughly curved boundaries of a former vast amphitheater, in which the snows of ages past accumulated to form a large glacier that flowed eastward down the mountain slopes. The extension of this ancient ice-stream to a distance of at least 10 miles from its source is today indicated by the presence of massive mo-

Photo by George M. Weister

RAINBOW ROCK, ON THE WEST SLOPE OF MIDDLE SISTER: NOTE THE SLATY JOINTED EXFOLIATION AT THE RIGHT

Photo by George M. Weister

LOOKING NORTHWARD ALONG THE CREST OF THE CASCADE RANGE; COLLIER GLACIER AT LEFT; NOTE DOUBLE-CRESTED LATERAL MORAINE IN MIDDLE FOREGROUND

"In all the splendor of their frigid though summer garb appear Mount Washington, Three-fingered Jack, the glacier-scored snow pyramid of splendid Mount Jefferson and Mount Hood, 100 miles distant" (see page 593)

Photo by George M. Weister

ICE FIELDS ON THE WEST SLOPE OF MIDDLE SISTER

"On steep inclines the climbing-rope and ice-ax are essential to a reasonable degree of safety"

Photo by George M. Weister

GIANT CREVASSE IN THE COLLIER GLACIER

"Where the rocks cannot yield, there the strong stress great rent cracks called crevasses are formed"

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GIANT CREVASSE AND ICE-WALL NEAR HEAD OF COLLIER GLACIER

"The lower wall drops down, leaving exposed a sheer ice-face on the upper side of the opening"

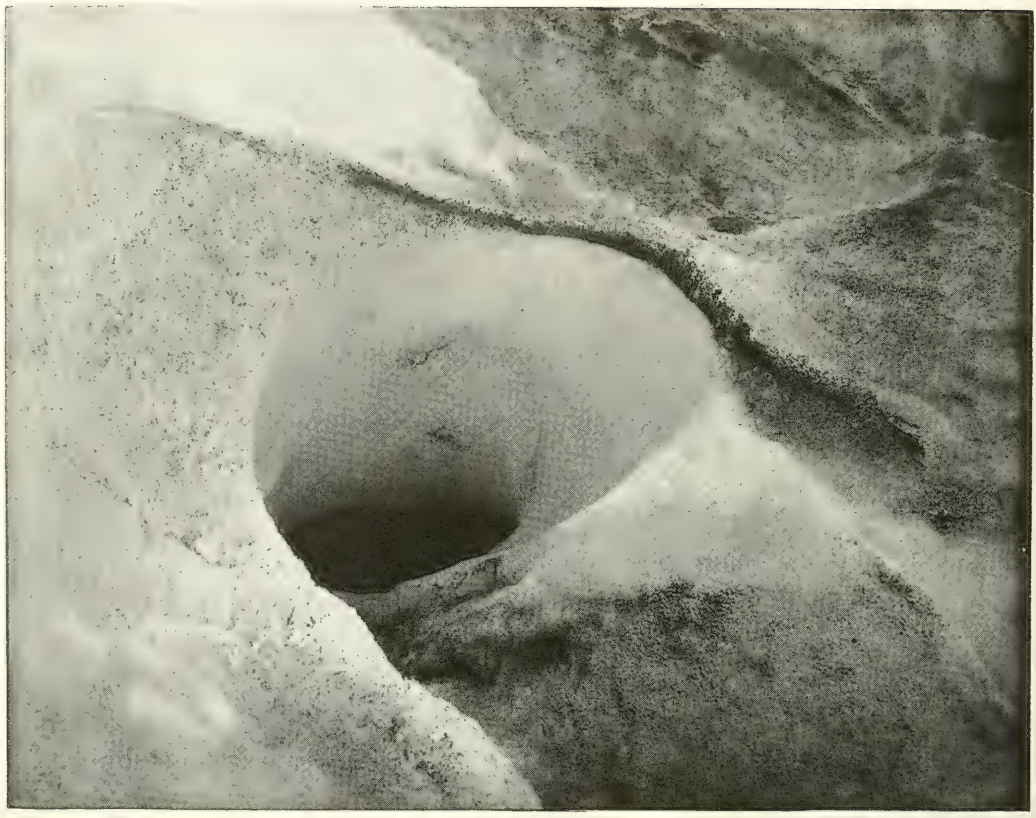

Photo by George M. Weister

AN ICE-WALL IN THE COLLIER GLACIER

"A circular opening into which the water plunges to unknown depths with a muffled, ominous roar"

raines, heaps of glacier detritus far down the mountain side.

The Three Sisters are typical volcanic peaks. Only the south and middle peaks, however, have sufficiently resisted the destructive processes to exhibit the distinctive cone profile of the volcano, and South Sister alone possesses still a shallow crater in its top. North Sister is an elongated, jagged ridge of unstable lava, culminating in a massive pinnacle with almost vertical creviced sides, whose 100 feet of height had, until 1910, so far as is known, successfully daunted the enthusiasm of all aspirants but one, Mr. H. H. Prouty, of Portland, Oregon, who, unaided, made the ascent in August of that year. This same season a committee of the Mazamas succeeded, by means of ropes, in placing the official record-box on the apex of the peak.

The peaks themselves are composed of volcanic materials entirely, and the varieties of rock represented in their masses and covering large adjacent areas in every direction suggest a succession of eruptive periods, during different ones of which different rock species predominated.

In general keeping with the trend of the Cascade Range, volcanic outflow seems to have proceeded from vents along a series of fractures in the earth's crust running north and south. Evidence shows that these eruptions have taken place at intervals throughout the long lapse of geologic time, from the Tertiary period almost to the present.

The earlier lavas were prevailingly andesitic, while the more recent craters have discharged vast quantities of basalt and other markedly basic extrusives. Aside from the symmetrical outlines and crater of South Sister, additional evi-

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SERACS AND ICE CAVERN AT EDGE OF GLACIER: AN EXCEEDINGLY ROUGHENED SURFACE IMPOSSIBLE OF TRAVEL

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LATERAL VIEW OF HAYDEN GLACIER

Persons at lower left will afford measure of height. Note distinct bands in the solid ice. Vertical angular depressions may mark outcropping of former crevasses

dence of the recency of volcanic activity is to be seen in the innumerable lesser, though more perfect, cones scattered up and down the range and the hundreds of square miles of barren scarcely traversible broken rock surfaces resulting from their outpourings.

Near by to the northward stand Black and Belknap craters, a bird's-eye view of which reveals clearly the manner of eruption, successive gigantic tongues and lobes of ropy, viscous, seething-hot lava spreading, like thick molasses, from an overflowing subterranean reservoir of supply. At times the eruptions were violent and the ejectamenta blown into the atmosphere in the shape of volcanic gravel, lapilli, and dust. Enormous quantities of such fragmental material have been scattered over the region. The so-called cinder cones are largely built in this way.

With the exception of North Sister, the ascent of the peaks is not difficult. South Sister is readily approached from the westward, a course taking advantage of the several snow slopes on the south of west side having been found most feasible. The summit of North Sister can be reached by following up the notched apex of the ridge from the south.

The entire structure of this mountain is in such a state of decay that all of its steeper slopes are occupied by unreliable slide-rock. These are being constantly replenished from the rapidly disintegrating ledges above, so that a secure footing or even trustworthy hand-holds are not among the certainties afforded him who essays the climb of North Sister peak.

For the average climber the ascent of Middle Sister from timber-line is a vigorous five hours' work. The early part of the climb is chiefly a clamber over rough boulder slopes, interspersed with long snow inclines, interest in which in climbing up is not to be compared with the exhilaration of tobogganing them on the way down.

At intervals one travels over fairly smooth areas of glass-like obsidian, dark, brilliantly reflecting surfaces, often striated or furrowed, or exhibiting the characteristic billowy *roches mouttonnées* produced by past glacial action.

Again, a detour is necessary to avoid steep faces or abrupt masses of beautifully columned basalt, individual specimens of which show a dense black matrix flecked with a plentiful scattering of bright green olivine grains, and less frequently of phenocrysts of plagioclase feldspar. Emerging promontories of porphyritic andesite of towering proportions, displaying conspicuous structural peculiarities, are also objects of interest.

These features all lend support to the fact that the process of eruption in the formation of Middle Sister was predominantly a quiet one. From an unknown number of breaks in her sides vast coulées of molten lava stiffly flowed down her slopes and deluged the surrounding country. The extensive work of the glaciers and the ceaseless action of the weathering agents have so far obscured the original course of events here that only the keen, interpretative eye of the geologist is able to decipher the mountain's life-history.

About a mile of the ascent of Middle Sister can be made over the ice and snow fields of the Renfrew Glacier. Its surface is not badly interrupted by crevasses, and rarely is it so steep as to render recourse necessary to more rigorous means than a safe, dependable alpenstock. The last 1,000 feet to the summit is again a clamber up an increasingly steep incline, covered for the most part with alternating loose slide-rock and coarse boulders of all shapes and dimensions. Over the latter hands and feet about divide honors in facilitating ascent.

The view from the top of Middle Sister is one of surpassing interest. To the westward the undulating forest green blends dimly, through the August haze, into the darkened outline of the distant Oregon Coast Range. Down the Cascade Range looms South Sister, with her guardian ramparts, the Husband and Broken Top, to the right and left respectively. Beyond, Diamond Peak is within the range of vision, and, somewhat bedimmed, Mount Thielsen, 75 miles away. At all angles to the westward the placid blue of nestling mountain lakes is a pleasing relief in the monotony of forest landscape (see page 584).

At one's very feet, to the east, repose Hayden and Diller glaciers, their glistening white not out of harmony with the verdant forest fringe, which in this direction is of less importance than to the west. Farther out, the geometric outlines of cultivated fields in the fertile valley of the Deschutes River are faintly discernible.

At the north, North Sister, Collier Glacier, and a deployed series of lesser volcanic craters are for the moment quite overshadowed by the transcendent array of magnificence against the northern horizon. In all the splendor of their frigid though summer garb appear Mount Washington, Three Fingered Jack, the glacier-scored snow pyramid of splendid Mount Jefferson, Mount Hood, 100 miles distant, and, in a favorably clear atmosphere, Mount Adams, 50 miles beyond Hood, in the State of Washington.

Fed by the snows which accumulate in a well-developed cirque at the northwest foot of Middle Sister, the Collier, in its mile and one-half of length, exhibits all the characteristics of a full-fledged Alpine glacier.

The Hayden and Diller glaciers at the east side likewise afford the student of glaciology most excellent opportunities to observe many features of glacial movement. Progress over their surfaces is easy or difficult, depending upon the slope of the different parts and the extent to which the ice has been fractured and crevassed by irregularities in the bed over which it flows.

As a rule the snow-fields at the head are comparatively level and passable. In the lower portions, where the deep snow has been largely compacted into solid ice, however, the variations in the rocky surface on which they lie often produce breaks that appear at the surface as partially covered ice-bound clefts or wide-open fissures, travel across which is either dangerous or impossible.

On steep inclines the climbing rope and ice-ax are essential to a reasonable degree of safety. Where the glacier proper starts down the steeper slope of the mountain, giant open cracks, called crevasses, are formed.

As the ice-stream slowly settles down the slope, the crevasses continuously formed above are in large part sealed again into firm ice. On the lower part of the glacier, however, where the bare ice is exposed free from snow, the surface is often deeply corrugated by what appear to be the accumulated remains of former open fissures. These are wide at times and their edges rounded by melting. Travel is difficult across such a surface, and possible only when footwear is properly equipped with ice-calks to prevent dangerous slipping.

The movement of a stream of glacial ice conforms in general to the laws of liquid flow. Contact with the sides and bottom of the channel retards movement, but ice, being a brittle solid where not under heavy pressure, gives evidence of this drag by the appearance on the glacier surface, and especially near its borders, of a network of joints or joint planes.

The motion of the ice and its exposure to active melting so exaggerates the presence of these intersecting lines of weakness as to develop exceedingly roughened surfaces impossible of travel. The roughly angular blocks that are thus marked out in the ice-mass are termed "seracs," and to the resulting pinnacled surface the same name is applied.

During the day the effect of insolation is seen in the many streams of water, in size from the trickling rill to the torrent, running on the top of the glacier. Few of these streams proceed far before they drop into a crevasse or other opening in the ice. The repeated daily work of such a stream often forms an "ice-well," a circular opening into which the water plunges to unknown depths, with a muffled ominous roar, to add its volume no doubt to the main stream that issues from the ice-cave beneath the snout of the glacier.

The Three Sisters' region is not difficultly accessible, and affords on the whole unexcelled opportunities for the study of varied phases of volcanic action and of the movements, character, and work of glaciers. With it all, the chance to exercise one's mountain-climbing propensities is an item to be regarded as of first importance.

Photo by A. H. Barnes

COWSLIPS ON THE SLOPES OF MOUNT RAINIER (SEE PAGE 607)

THE GREAT WHITE MONARCH OF THE PACIFIC NORTHWEST

By A. H. Barnes

Author of "Our Greatest Mountain and Alpine Wonders"

With Photographs by A. H. Barnes

MOUNT RAINIER is wonderfully associated with the far-famed Puget Sound. In company with the lesser peaks of the Cascade Range and Olympic Mountains further to the west, it stands as the great white monarch of the Pacific Northwest, the pride of Indian lore and myth. It overlooks the vast prairie empire of eastern Washington and westward the timbered region to the shore of the Washington coast, and in favorable weather is seen from considerable distance at sea.

It was less than two years ago that a prominent New York magazine published an article, wherein it was stated that the glaciers of Glacier National Park were the only living glaciers in the United States, when in fact the State of Washington contains six glacier-covered mountains, besides many detached sections of perpetual ice and snow regions among the Olympic and Cascade ranges not indicated by general maps. Mount Rainier alone probably has more bulk of glacier than the whole State of Montana, for it is estimated by our best geographic authority that Rainier radiates more volume and area of ice than any other one mountain in the world. The area of glacial surface is estimated at 52,000 acres.

Mount Rainier, "our greatest mountain," is the highest (?) and largest glacier-covered mountain in the United States. To the stranger in Puget Sound

Photo by A. H. Barnes

VIEW OF MOUNT RAINIER FROM SPANAWAY LAKE, 40 MILES DISTANT, SHOWING STORM-CAPS (SEE PAGE 598)

Photo by A. H. Barnes

A BANK OF WHITE HEATHER AT TIMBER-LINE ON MOUNT RAINIER (SEE PAGE 607)

Photo by A. H. Barnes

A BRANCH STREAM OF UPPER PARADISE RIVER IN THE MORNING, SHOWING MOUNT RAINIER IN THE DISTANCE

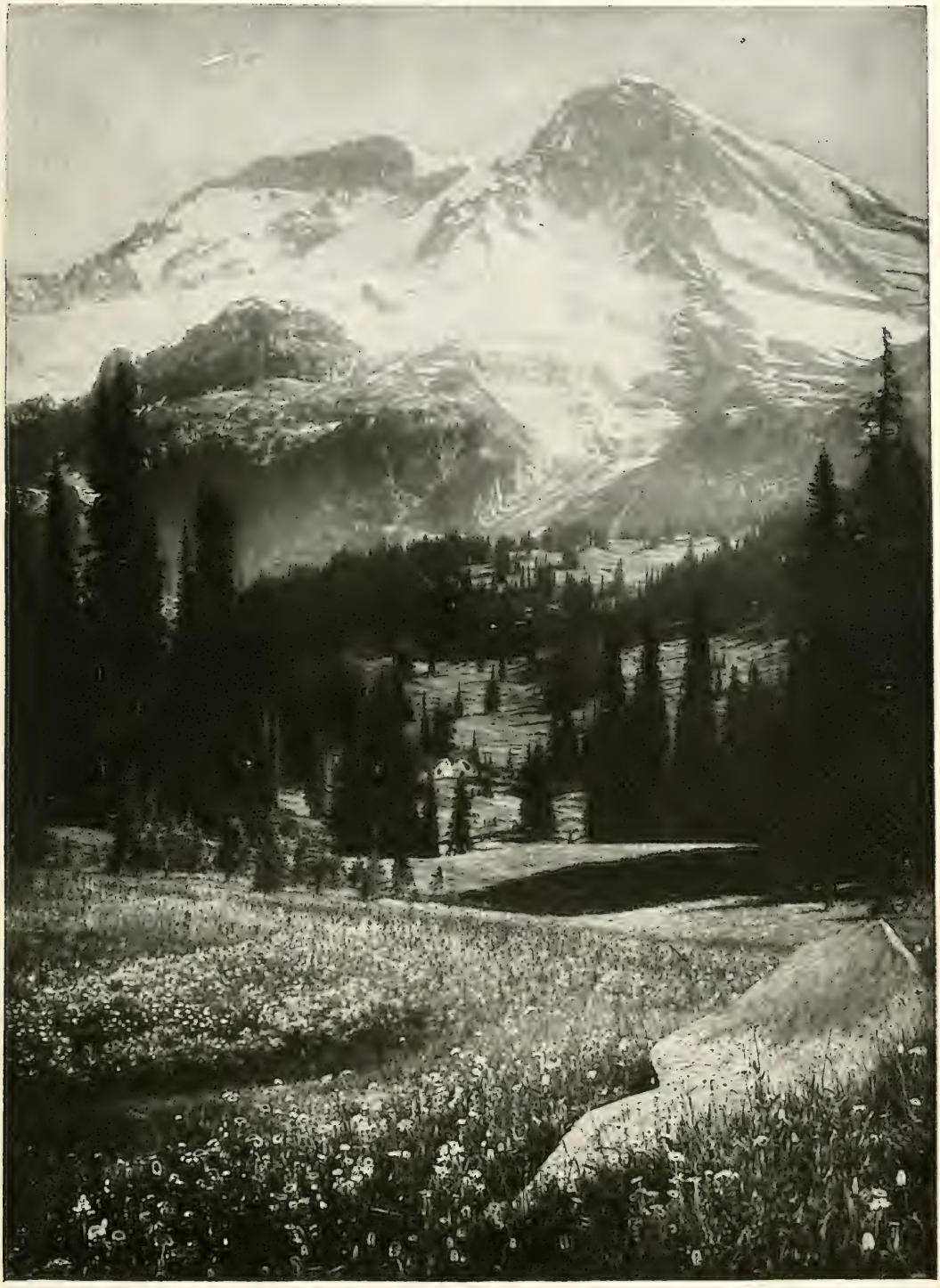

Photo by A. H. Barnes

GLACIERS OF THE SOUTHWEST SLOPE OF MOUNT RAINIER

it appears to be less than 10 miles away, but on further inquiry the tourist learns that it is more than 40 miles distant, direct line from sea-level at Puget Sound, from where mountain survey measurements are made and all Rainier Park travel starts.

Studying it more in detail, he begins to comprehend its size and rugged anatomy. But the scene is beginning to change; the sun is low in the west; the lower end of the glaciers, white a few minutes ago, become a graded tint of rose pink; the blue has changed to a purple, but the summit is still white, for it is 7,000 feet higher than the snow-line and projects up into the white rays of the setting sun. The red rays are slowly moving up the mountain; the summit has changed to rose hue, the last coloring of day, which it holds for some minutes after the sun has left the landscape, and then changes back again finally from warm to the cold purple afterglow that generally precedes a summer night on Puget Sound. Many yards of canvas and photo film have been used on this distant subject, and even the best pictures but belittle the mountain's ever-changing grandeur and magnitude.

Viewing Mount Rainier after the weather has been fair for some days, it is common to see the summit covered with a cloud. This cap is very interesting and is always looked at for a forecast of a change of weather, especially when it forms immediately in contact with the summit, hugging down closely like an inverted saucer. When the cap forms suddenly, like the sudden drop of a barometer, the change of weather is not long coming. The cap does not always touch the mountain top, but is occasionally some distance above and holds its shape during a whole day or more.

From a far distance this cap appears to be a still cloud with no motion, but in studying it from close range one will observe that at the west edge the cap develops rapidly, dissolving to invisible condition at the east edge. Evidently it is a stationed point of condensation, but not a stationed accumulation of moisture. I have studied the philosophy of this cap at close range during 16 seasons' visits and never have seen a still or real calm condition on the mountain's summit at the time; there is always some wind and most generally a gale (p. 504).

Another caplike cloud often forms some distance to the northeast of the summit and considerably higher. What relation this one has to the mountain is much more difficult to explain. It is probably due to the condensation in an eddy or junction of wind currents that on their coarse come together some distance beyond the mountain top, which has disturbed the wind like an island divides a river into two streams that join again in one some distance beyond.

In places among the higher mountains on lee slopes, where snow is not disturbed by wind, the pack of one season's fall is sometimes 50 feet deep as late in the season as September. The snow garment of the mountains is their chief feature of attraction, for but few people would visit these piles of lava were it not for the great ice fields.

The crater of Rainier, concerning which many questions are asked, is not dangerous, but rather a life-preserver, and has been so used during storm. There are no openings within the crater large enough to be dangerous. The whole circle of 1,600 feet diameter is filled with fallen black lava and covered with a thick pack of snow the year round, except at the edges near the crater's rim, which are kept melted by continual warmth. The main crater was the mountain's principal vent of eruption, but there is one other place called the little crater; it and a few other spots near the top are also warm.

The first parties to the summit always made the crater their inn, where they stayed at night, warmed by the steam that issues from the small fissures just within the crater's rim; but of late the plan has been to reach the summit from Camp of the Clouds (elevation, 5,500), starting about 1 a. m., reaching the summit just after noon, and, after some hours' rest returning to camp the same evening.

In making a trip to the mountain's summit, August, 1911, the writer took

along a thermometer to ascertain the steam temperature, and found the steam of the main crater in places to be about 150° F. There are other places where the heat is about boiling point.

Professor Flett boiled ice water in a tin cup over a steam jet in less than 10 minutes.

The steam is evidently snow water that seeps down to where it comes in contact with the internal heat, returning in vapor through the same general openings. It seems to contain no gas or fumes, and is of feeble force and little volume, soon disappearing in the high, dry atmosphere.

It is not seen from a far distance and is not a factor in producing the cloud cap that forms on the summit previous to storm. Some have advanced the theory that the steam makes the cap, but there is nothing in the study of the phenomenon to warrant it. Heavy barometer pressure would not force out an extra amount of steam (as some have expressed); it would tend to hold steam in; and, besides, the steam is of very small quantity. None of the summit visitors have ever seen a large volume of steam coming from the crater openings.

Publications stating that smoke and fire come from this volcano during seismic disturbance have no foundation of fact, for it is evident that no civilized man ever witnessed such a sight, and that volcanic action in this section is a phenomenon of the long past. People have been misled in seeing a cloud that appears like smoke, and hurry to announce their delusion.

Since 1870, when the first ascent was made, hundreds of people have stood on the summit of our great white "Templed Hill." A climb to the summit and return the same day is a long, wearisome undertaking, slightly dangerous, especially at one place rounding the upper part of Gibraltar rock (see page 600), from which there is an occasional shower of small pieces of rock that thaw loose from the snow patches above. So far as is known, there has been but one life lost in climbing the mountain, due to natural cause; the few others were lost owing to recklessness and lack of judgment. The crevasses are very bad if one gets into them, but they have generally been cleverly avoided.

The chief official guide, who made 17 trips to the mountain top during one season, found the temperature near freezing point each time except on one occasion, when the warm belt of air extended to the mountain's summit, which is very unusual and in mid-summer only. The moisture of these coast mountains keeps it from seeming as rarefied as would be the same altitude in the Colorado Rockies.

From almost any close or distant position the glaciers are looked at so obliquely that one never fully comprehends their area as well as when making a climb to the summit. Patches of the glaciers are apparently very small from lower views, but when favorably seen from a near eminence become vast arctic fields carved by wind and sun into weird spires and domes.

Studying the crevasses and the actinic blue coloring they reflect will repay any one who has a day to devote to the climb. The higher up, the more curious are the carvings of the snow surfaces, which would indicate that the winds are the chief factor in making the peculiar whittlings.

This great pile of lava, heaped to an elevation of nearly 15,000 feet, is characterized by several features deserving of special individual study. The geologist, geographer, botanist, poet, painter, landscape gardener, and specialist all find a wealth of interest throughout this 324 square miles of reserve, besides much adjacent territory comparatively unexplored. Since the original stage and pony day travel has given place to railway and auto, the autoist finds a new territory, and now in the winter the skeer and snow-shoer are beginning to look toward the Rainier Park for their sports.

To a woods-dweller the timber is a matter of course, but to those who have not been amid large forests it is one of the very special features of the reserve and an educator in forestry of the best

Photo by A. H. Barnes

THE 1,200-FOOT WALL OF GIBRALTAR ROCK: MOUNT RAINIER (SEE PAGE 599)

Photo by A. H. Barnes

CREVASSE ON DIVIDE OF THE PARADISE AND LITTLE COWLITZ GLACIERS: MOUNT RAINIER

Photo by A. H. Barnes

CAVERNS ALONG THE WAY, ABOVE CAMP MUIR, ON MOUNT RAINIER (SEE PAGE 599)

Photo by A. H. Barnes

A PARTY LEAVING CAMP MUIR IN THE EARLY MORNING FOR SUMMIT OF MOUNT RAINIER (SEE PAGE 599)

Photo by A. H. Barnes

A SLOPE OF ROSE-RED HEATHER ON MOUNT RAINIER (SEE PAGE 607)

Photo by A. H. Barnes

A SPECIMEN OF ROSE-COLORED HEATHER ON MOUNT RAINIER (SEE PAGE 607)

kind. From the dense forests of the valleys and on the lower slopes, where trees grow to a height of over 300 feet, some with a diameter of 12 feet, the forester can trace the diminution of growth as the ascent is made to the scrubby brush-like trees at timber-line, struggling, as it were, for their existence.

To a landscape gardener the park is the best natural teacher. The promiscuous style in which nature has planted the shrubbery is ever a wonder. Where plant growth seems impossible, one finds the most thrifty flowers adorning a rock wall, on top of which grow clumps of alpine fir, hemlock, and Alaska cedar, dwarfed and miniatured by high altitude and lack of substance. Where seemingly no vegetation can live, they have been for generations rooted into the fissures of the high cliffs, eking out an existence on but a few bushels of soil.

The unvisited portions of the Rainier Park without doubt contain, yet unseen,

Photo by A. H. Barnes

BASKET-GRASS FLOWER ON MOUNT RAINIER (SEE PAGE 608)

such features as hot and cold springs, falls, small lakes, and botanical rarities. High on the ridges and slopes of the neglected corners of the park the wild goats make their home. Sometimes they have been seen in numbers of 30 or more together. The deer, which are more abundant than any other of the large game, are occasionally seen from along the Government road. The black and brown bear are also seen, and at rare intervals the stealthy cougar or puma.

The tourist season is generally from June to the last of September, and sometimes after the first snows of autumn have melted favorable weather is prolonged to November. In staying through the whole season the visitor will experience a gradual change from the early summer, green with flowers and melting snow banks, to rich coloring in the leaf foliage of autumn, enveloped in hazy atmosphere of purple gray.

Between 5,000 and 8,000 feet elevation the botanist finds Rainier Park his paradise, wherein there have already been found over 250 varieties of plant life, a dozen or more kinds belonging to this region alone. The majority of the flowers are of light tint, but there are a liberal quantity of blue, red, and yellow, so deep and pure of color that artificial pigments fail to imitate them. The distribution of several species of heather is a technical touch of finish in the evergreen, tipped in summer with clusters of small bells in colors purple, pink, yellow, and white.

The white heather—*Cassiope mertensianna*—though not so abundant as the red, because of its winsome, delicate, pure white bells, with red sepals and fine stems, delicately attached to its fine evergreen foliage, is the general favorite of the heather kinds (see page 607). This species also grows the highest, being sometimes found at 8,000 feet altitude. While the shrub is hardy, the flowers do not appear until some days after snow is gone and last but a short season. This heather is also the choice of the Scotchman, being nearer in style of flower and foliage to his native heather than the other forms here found.

The red heather, by some people called purple, more accurately speaking is deep pink of purple tint. Its growth is abundant between 5,000 and 6,000 feet elevation (see pages 604-5). Its thick clusters of bell-like flowers display pleasing contrast to the rich green landscape. The sepals and stems of this bell have a very unusual color, being of a light sienna brown. The pollen at one stage is dark gray, another singular feature. The heathers are favorites with the bees.

The cowslips — *Caltha leptosepala* — like several of the mountain flora, is scarce, especially in some localities, and not seen much by the vacationist in general (see page 593). Growing mostly in wet places and now and again partly covered with overflow from a near-by torrent, this flower appears to the casual tourist as belonging to the water-lily kind, but it is not so classed by the botanist. The flowers are medium size, with petals of dull yellow, almost white, harmonizing well with its stamens of deep yellow. This plant is very hardy to cold and moisture and comes early, ending its season before some of the late flowers have made their appearance.

The mountain meadow aster—*pulchellus*—not noted for its great abundance over a large area, is thrifty and plentiful in patches in moist flats where grass is thin (see pages 614-615). Its intense golden yellow center, encircled with a liberal number of light-purple petals, is its special feature. The short stems are greenish and graded to dull dark purple and wine color. It has seldom more than one head. The perfume is very mild and pleasing. The flowers are sensitive to cold, moisture, and darkness, with great tendency to close after the heat of day.

Anemones of luxuriant growth come early, and sometimes force their way through the edges of lingering snow beds. The blossoms appear first, but their carroty-like foliage is out in full fledge by the time the flowers are fully developed. The flowers are about two inches across, of a dull cream gray tint, nearly white, grading to dull purple hue near the lower ends of the petals as they

grow older. The centers are full of long yellow stamens.

The anemone is especially deficient in perfume, a common failure with the mountain flora. Though the plant ends its blossom season early, its seed pods are covered with a spectacular flume of light brownish gray that attracts attention to the end of summer (see pages 612 and 613).

Mountain rhododendron—*Albiflorum.* How flowers derive common names is not always traceable; the mountain people took to calling this the snow brush. Its waxy one-petal bell flowers of cream white, about three-quarters of an inch wide, are very delicately fastened close to the stock, tucked away under its canopy of glossy light green leaves. Flowers are easily shattered from the stock, but for further protection nature seems to have planted this shrub generally in the shelter of other woods. The stamens and pistels are of same tint as the petal; the odor is slightly unpleasant. This plant deserves much attention as a flowering bush (see page 610).

Basket grass flower, or mountain lily—*Xerophyllum tenax.* The Indians dig up this plant, bleach its long fibrous leaves, dry them and weave them into small baskets, cups, and ornaments. Some people call it squaw grass. At 4,000 feet altitude, scattered over thickly wooden slopes, this evergreen bunch grasslike plant grows most thrifty. After several years a number of stocks shoot up from one set of bulbs; after then the plant rests a few seasons.

In the more abundant places the stock grows three to four feet tall, covered with its hundreds of tubelike flowers of waxy cream tint, almost white. This is the most spectacular flower of the mountain. It grows prettiest at an altitude of over 5,000 feet, where it has shorter stem and better form, but is very scarce. The stock then assumes a wine-color tint on sunny side. On close examination as well as at a distance, this plant is always a winner (see pages 606 and 609).

Gentian—*Gentiana calycoso.* If there is a favorite blue flower in the Rainier Park, it is the gentian—blue, blue, blue. It comes to full bloom about the last of August. It is not of great abundance, but is a plenty, and often puts forth 15 to 20 flower stocks in one bunch. The stems are about eight inches long, but, like all plants it varies in size according to surrounding conditions.

The color is light cobalt at the top ends, the petal grading to deep purple blue toward the stems, which are often green, but usually of a dark wine color. The ends of the green leaves are also tinted the same as the stem, completing a scheme of wonderful color harmony. Partly hidden by other herbage, this flower is not conspicuous and sleeps late, opening in full only during the heat and light of day, but its season lingers on through the first light frosts.

Castellira areopala. Indian pink paintbrush, painted cup, are the common names of this wonderful, showy plant. While its perfume is scarcely noticeable, it is undoubtedly the most conspicuous of the park flora. Abundantly scattered over the meadows and slopes in separate clusters and thick patches, this species, in its deep magenta red, displays wonderful contrast to the rich greens. It varies some in lighter tints of the same pigment; some flowers are of scarlet, and rarely is seen a freak nearly white. The flowers flash into full bloom all about the same time and hold out fairly well to the middle of August. It appears best at short distance and coarse on close examination, but with nearly every one this flower lists with the favorites.

The few flowers described are but a mere introduction to the subject. Nature was bountiful and gave Rainier Park many kinds and colors. The avalanche or deer-tongue lily—*Erythronium montanum*—ranks among the best and most showy (see pages 616-617). It comes very early and in abundance. Following its season comes the light rose-colored mimulus, growing always close along the ice-cold streams.

The delicately scented valerian, scattered over knoll and slope, can be seen for some distance. The heads, on stalks two feet or more in length, are made up of many flowers of pure white (see page 611). The mountain phlox, grow-

Photo by A. H. Barnes

ANOTHER CLUMP OF THE BASKET-GRASS (SEE PAGE 608)

Photo by A. H. Barnes

SNOW-BRUSH, OR MOUNTAIN RHODODENDRON *(Rhododendron albiflorum)* ON MOUNT RAINIER

A bush flower that grows in company with other woods. Flowers pale lemon, cream, nearly white (see page 608)

Photo by A. H. Barnes

VALERIAN ON MOUNT RAINIER (SEE PAGE 608)

Photo by A. H. Barnes

ANEMONE SEED PLUMES (SEE PAGES 607-608)

Photo by A. H. Barnes

ANEMONE IN MOUNT RAINIER NATIONAL PARK

ing close to the ground, adorns the rocky ridges with small flowers of white and delicate lavender. One other form of the aster, with its deep yellow centers and delicately tinted petals, grows in abundance o'er vale and slope, like a pleasant smile in an Alpine wild; and also many other mountain beauties with all the splendor of a Burbank masterpiece.

The first white man to visit the mountain was Dr. Wm. F. Tolme, of the Hudson Bay Company, from Fort Nisqually, who in 1833 closely approached some of its glaciers. Gen. A. V. Kautz, in 1857, made an attack of the mountain, but it has never been affirmed that he reached the true summit. In 1870 Messrs. Van Trump and Stevens succeeded in reaching the summit of the highest peak.

The Rainier Park was not much visited until the last three seasons. In 1911 upwards of 11,000 tourists registered at the park entrance. Since the days of early travel by pony and stage have given place to railway and auto, the tourist can make the journey from Seattle or Tacoma to the mountain snow-line in a few hours' drive.

A look at the great white mountain, rosy at early dawn, white at noon, changing back to warm glow at the close of day, has ever been a power to uplift; but

Photo by A. H. Barnes

MOUNTAIN MEADOW ASTERS: MOUNT RAINIER (SEE PAGE 607)

Photo by A. H. Barnes

A SPECIMEN OF THE MOUNTAIN ASTER (SEE PAGE 607)

Photo by A. H. Barnes

AVALANCHE LILY SLOPE: IN RAINIER NATIONAL PARK (SEE PAGE 608)

the students of nature, like the musician, experience more than they express.

The first writer to give detailed expression of enthusiasm about the mountain was Theodore Winthrop, in his book "Canoe and Saddle." After a voyage of more than 100 miles in a canoe paddled by Indians, Mr. Winthrop, in 1853, rounded a point at the entrance of the present Tacoma Harbor in full view of the mountain.

"We had rounded a point and opened Puyallup Bay, a breadth of sheltered calmness, when I, lifting sleepy eyelids for a dreamy stare about, was suddenly aware of a vast white mountain dome of snow swelling and seeming to fill the aërial spheres as its image displaced the deeps of tranquil waters. . . . Kingly and alone stood this majesty, without any visible comrade or consort, though far to the north and south its brethren and sisters dominated their realms, each in isolated sovereignty rising above the pine-darkened sierra of the Cascade Mountains. . . . Of all the peaks from California to Frazer's River, this one before me was royalest. Mount Rainier, white men have dubbed it, perpetually the name of somebody or nobody; more melodiously, the Indians call it Tacoma."

Again Mr. Winthrop expresses himself from his saddle, while riding toward the mountains: "I had been following thus for hours the blind path—harsh, darksome, and utterly lonely—urging on with no outlook, encountering no landmark. . . . As I looked across the solemn surges of forests, suddenly above their somber green appeared Tacoma. Large and neighbor it stood, so near that every jewel of its snow fields seemed to send me a separate ray, yet not so near but that I could with one look take in its whole image, from clear-cut edge to edge."

Mr. Winthrop pictured almost exactly the condition of the world-old fires, at the present day not entirely lifeless. "If the giant fires had ever burned under that cold summit, they had long since died out. The dome that swelled up had crusted over and then fallen in upon itself. . . . Only the thought of eternal peace arose from this heaven-upbearing, monument-like incense, and, overflowing, filled the world with deep and holy calm." . . .

Photo by A. H. Barnes

AVALANCHE OR DEER'S-TONGUE LILY

Photo by A. H. Barnes

CLIMBING SOME OF THE UPPER FEEDERS OF THE WHITE RIVER GLACIER, NOT FAR BELOW THE SUMMIT OF MOUNT RAINIER

Photo by Charles Bedford, from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

A PERILOUS POSITION ON THE EDGE OF A GREAT CREVASSE: COWLITZ GLACIER, NEAR END OF CATHEDRAL ROCKS

Photo by B. L. Aldrich, Jr., from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

MOUNT RAINIER: SEEN FROM PUYALLUP RIVER, NEAR TACOMA

Photo by Asahel Curtis, from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

LOST TO THE WORLD: 7,500 FEET ABOVE SEA-LEVEL, WITH AN OCEAN OF CLOUD RISING

Photo by Asahel Curtis, from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

CROSSING A PRECIPITOUS SLOPE ON WHITE GLACIER: LITTLE TAHOMA IN DISTANCE

Photo by Asahel Curtis, from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

THE SIERRA CLUB ON NISQUALLY GLACIER

Photo by Charles Bedford, from "The Mountain That Was 'God,'" by John H. Williams: G. P. Putnam's Sons

VIEW SOUTH FROM COWLITZ GLACIER: ELEVATION, 8,000 FEET

Seven miles away are the huge eastern peaks of the Tatoosh. The Cascades beyond break in Cispus Pass and rise on the left to the glacier summits called Goat Peaks. The truncated cone of Mount Adams, more than 40 miles away, crowns the skyline

Photo by Prof. Ellerman

AN ISLAND IN AN OCEAN OF CLOUDS: VIEW FROM THE SUMMIT OF MOUNT WILSON, CALIFORNIA

Photo by Prof. Ellerman

A BILLOWY OCEAN OF CLOUDS ENGULFING THE LAND, AS SEEN FROM THE SUMMIT OF MOUNT WILSON, CALIFORNIA

Photo by Prof. Ellerman

FOG FILLING THE VALLEYS, WITH SNOW-CAPPED SAN ANTONIO ("OLD BALDY") IN THE DISTANCE

OUTLINE MAP SHOWING LOCATION OF MOUNT RAINIER

BOOKS ON MOUNT RAINIER

Two beautiful books describing the wonders of Mount Rainier have been published recently. Each is profusely illustrated with photographs, some of them being in colors, and each gives a very vivid picture of the mountain. The first is by Mr. A. H. Barnes, who has given his work the title of "Our Greatest Mountain and Alpine Wonders," while the second is by John H. Williams, "The Mountain That Was 'God.'" Several of the 200 photographs illustrating the latter book are published in this number by courtesy of Mr. Williams. Copies of the books may be obtained from Lowman and Hanford, Seattle, or from the Central News Company, of Tacoma, for 75 cents per copy.

Photo by Mrs. H. A. Towne, from "The Mountain That Was 'God,'" by John H. Williams.

ALPINE HEMLOCK AND MOUNTAIN LILIES.

In the struggle for existence at the timber-line, flowers prosper, but trees fight for life against storm and snow.

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